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ABSTRACT

This collection of conference papers includes: "Building a Pedagogical Model for Synchronous Distance Learning Courses" (Panagiotes S. Anastasiades); "Delivery of Courseware using CD-ROM Media" (Brian Brighouse and Denis Edgar-Nevill); "Lessons Learned from Blended Biology Classes" (Arthur L. Buikema, Jr.); "Everything I Ever Needed to Know I Learned in Seminar 101: Organizing the First Year for Dynamic Interactive Learning" (Karen Casto and Justina Brown); "Teaching Technology in an Online Distance Environment" (Timothy J. Ellis, Maxine S. Cohen, Frank Mitropolous, and William Hafner); "Facilitating Interaction in Web-Based Instruction" (Transfer of Learning: Evaluating Workplace Transfer of Training Techniques" (Wendy Flint); "Encouraging Innovation: Planning and Evaluating Technology Programs" (Nancy P. Hunt); "Differences in Predictors of Online and Classroom Performance" (Louis F. Jourdan, Jr.); "The Virtual Anesthesia Machine: An Educational Experiment in Interactive Real-Time Web Simulation and Philanthropy" (Sem Lampotang); "Ventures in Dichotomy: Rigor and Tolerance in the Education of Beginners" (Hector LaSala); "Learning Cubes: A Model for Online Education" (William P. Messier); "The Impact of New Technology on Music Appreciation Courseware Created and Used for a College Distance Learning Course" (David Sonnenschein); "Improving Strategic Knowledge in Physics" (Ioana Cristina Tutor and Florea Voiculescu); and "Teaching Market Failure through Interactive Instruction" (Lynda Vargha). (Papers contain references.) (SM)

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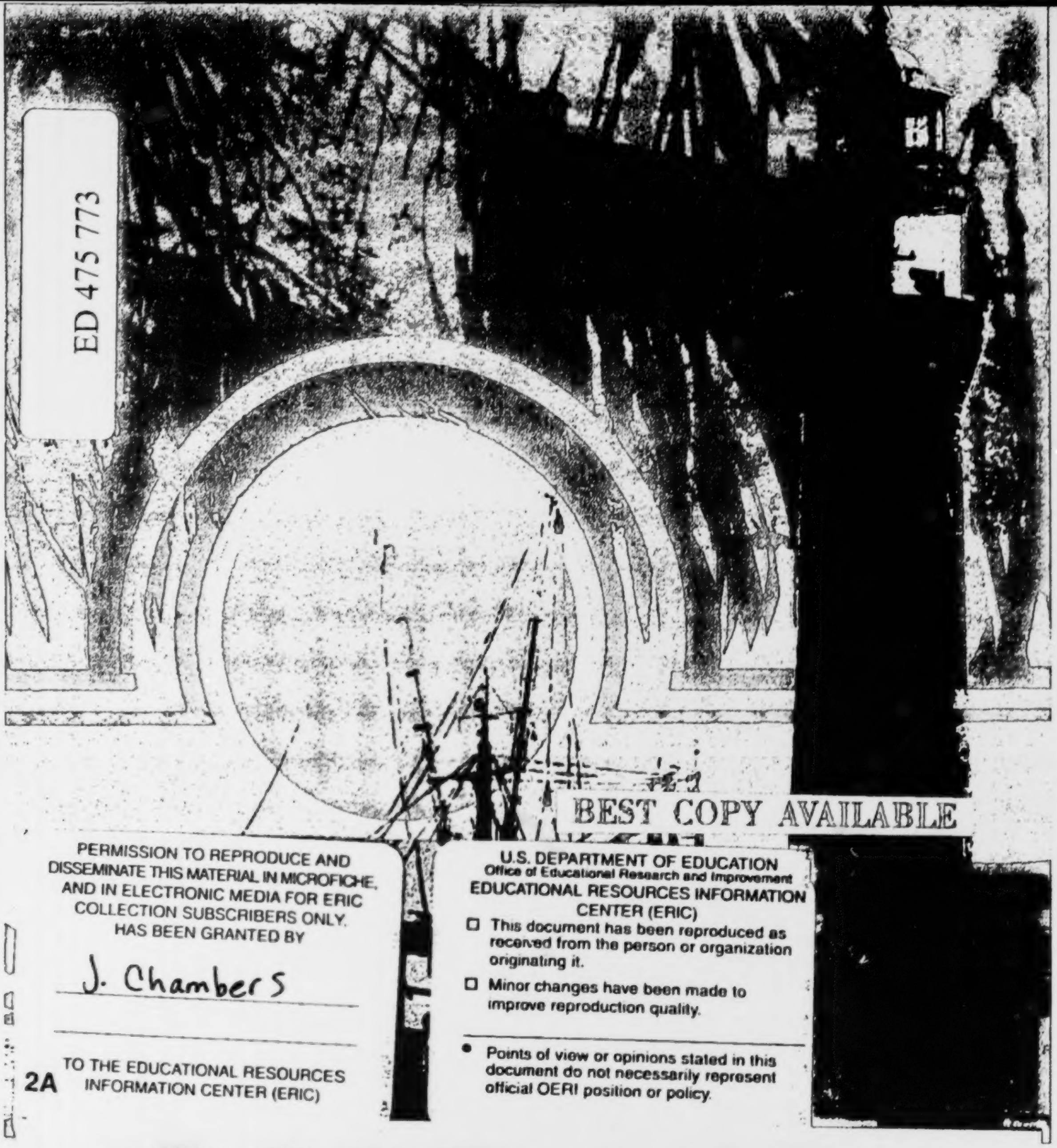

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SELECTED PAPERS

from the
14th INTERNATIONAL CONFERENCE
on
COLLEGE TEACHING AND LEARNING

Edited by Jack A. Chambers

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The Center
for the Advancement of
Teaching and Learning

SELECTED PAPERS
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14th INTERNATIONAL CONFERENCE
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Jack A. Chambers

Florida Community College
at Jacksonville

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FOREWORD

The Center for the Advancement of Teaching and Learning (CATL) was developed in 1987 when Florida Community College at Jacksonville accepted K. Patricia Cross' challenge to use the classroom as a modern laboratory for conducting experiments to gauge the impact of teaching on student learning.

The philosophy of the Center for the Advancement of Teaching and Learning is that classroom teachers are the key to improving student learning; the Center is therefore composed of faculty members under the guidance of a steering committee which consists of faculty from each of the four major campuses of the College. Part of the Center's success can be attributed to the numerous opportunities given to faculty to test their teaching ideas and to put research results into practice.

Center Steering Committee members serve as Campus Online Mentors and as sponsors of faculty development programs, both college-wide and on each campus. The Center also supports faculty mini-grants for classroom research and professional development and sponsors a number of awards honoring teaching faculty. The Center itself has been the recipient of an award—the Theodore M. Hesburgh Certificate of Excellence—for its faculty development programs.

In an effort to stimulate creative discussion and promote experimentation to improve the teaching/learning process, as well as to honor those who have already significantly improved learning in higher education, the

Center annually sponsors an international conference. The conference features recognized educational leaders in diverse areas of teaching, learning and technology. Since its inception, the conference has grown steadily and now attracts nearly 1,000 scholars annually from around the world. This publication, *Selected Papers*, was created as a result of Center interest in honoring faculty who develop some of the most outstanding contributions to the conference. It also preserves and makes available the contributions made to the teaching profession as a whole. *Selected Papers* is abstracted in ERIC and covered online by the American Psychological Association's PsycINFO.

Many people are responsible for the success of the annual conference. We would like to thank all participants, including featured speakers and workshop leaders; presenters from universities, liberal arts and community colleges throughout the United States and abroad; faithful attendees; and Florida Community College faculty and staff who give so generously of their time and efforts each year to help the conference continue its success.

Both the international conference and the *Selected Papers* journal have increased in growth and focus over the years. This year's publication contains articles selected as the 15 best papers of those submitted to the *Fourteenth International Conference on College Teaching and Learning*; they represent a cross-section of nearly 300 faculty presentations. All papers submitted for consideration in this year's journal were reviewed by the Florida Community College faculty members listed below. Papers were judged on the following criteria:

- Quality of content

- Quality of writing and presentation
- Focus of the paper (i.e., teaching, learning, technology)
- Discipline
- Appeal to an audience of professional, post-secondary educators
- Theoretical or practical applications

We hope you will find the ideas presented here applicable and inspirational to your own teaching, learning and research. Please plan to join us at the *Fifteenth International Conference on College Teaching and Learning*, March 29-April 2, 2004, in Jacksonville, Florida.

Rosalyn Amaro Professor of Business	Jenny Ohayon Professor of Humanities
John Mullins Professor of Biology	Bill Wolson Professor of Geography

BUILDING A PEDAGOGICAL MODEL FOR SYNCHRONOUS DISTANCE LEARNING COURSES

Panagiotes S. Anastasiades
University of Crete

INTRODUCTION

Knowledge in the Information Society (Anastasiades, 2000a) is recognized as the most important productive factor in modern times (Hannafin, et al., 1994). Our educational systems seek to meet these needs by modernizing infrastructures, training, and testing new teaching, learning and evaluation methods.

The new information and communications technologies make possible the development of a totally different educational environment (Hawkridge, 1976). One of the characteristics of this new technological age in education is likely to be the transition from traditional classroom-based learning to a significantly greater emphasis on independent student learning. (Wedemeyer, 1971).

The process of distance learning (Keegan, 1993), the use of educational multimedia (Boyle, 1997) and virtual learning environments on the Web (Collis, 1997) create conditions conducive to the development of life-long learning. However, these new educational technologies require traditional pedagogical approaches to be examined and revised as needed to meet the needs of the new educational environment (Raptis & Raptis, 1997). In this paper the most important steps for the establishment of an alternative pedagogical model for distance learning courses will be examined.

THE PROBLEM

The integration of new technologies in learning is not an easy task (Papert, 1997). The use of computers and educational multimedia, the establishment of network infrastructures and the provision of videoconference systems facilitate the technological aspect of this endeavor (Harley, 2001). These tools, however, are simply the first step in the transition from the current, conventional educational system to the new model of the virtual classroom, and the blended or hybrid class environment (Anastasiades 2000b; Rosbottom, 2001).

Prior to use of the above, it is necessary to develop a pedagogical model which will form the basis for application of these technological tools. During the last thirty years there has been considerable discussion concerning distance learning models, as distinct and separate from the traditional learning model. Some of these discussions centered on the methodology of independent study (Wedmeyer, 1971), the learner autonomy (Moore, 1977) and interaction and communication (Holmberg, 1986). A comparative analysis of all such theories recognizes their importance but realizes that they cannot be considered a complete pedagogical model (Keegan, 1993). "In our days, distance learning is becoming more traditional, while traditional learning is using techniques formally associated with distance" (Picciano, 2001, p. 63).

From this point of view, it is not necessary to develop a different theory for distance learning, but a new, common theory. Clark (1983) pointed out that a model "...that merges distance education and traditional education, should be considered and pursued instead" (1983, p. 448). By adopting Clark's theory we get a different dimension on the significance of a hybrid educational environment.

The balance of our educational system in the past has been based on a relation of two pillars of education, students and their instructors. This new model creates the emergence of a third pillar, that of the new educational technologies which tend to gain more and more vital ground.

The introduction and extensive use of educational multimedia creates a totally different learning environment Pictures, videos, sound, colorful and aesthetic texts attract students and turn traditional teaching into a kind of educational game for the younger and a cooperative environment for the older trainees. Training software programs simulate real circumstances and greatly assist the students in getting an experiential understanding of the material being taught, covering a wide gap of the traditional teaching system. The educational digital entities (Anastasiades, 2002) are an integration of graphics processing technology and persons who will undertake a supportive role in the teaching of selected subjects.

The proposed pedagogical methodology was chosen as a result of experience with the project ODUSSEAS (Anastasiades, 2003). This project, begun in 2001, is taking place in primary education in Cyprus and Greece. It will continue through 2004. ODUSSEAS is a collaborative effort of the Ministry of Education of Cyprus, the Department of Computer Science at the University of Cyprus and the Bank of Cyprus. The elementary schools that are participating in ODUSSEAS, Helenio Elementary School of Nicosia and Elementary School of Limassol, previously had considerable experience in the area of videoconferencing through the OIKADE program. This program may be reviewed at www.oikade.gr. (Anastasiades, et al., 2001).

THE PEDAGOGICAL MODEL: LEARNING THEORY, PRINCIPLES, STEPS AND METHODOLOGY

Learning Theory

The transition from the current model of the conventional classroom to the new hybrid learning environment is not a small matter, since there are several factors obstructing such change (Anastasiades, 2003). To achieve this transition, the methodology recommended is based on the school of social bibliography (Dede, 1996; Eastmond, 1995; Jonassen, et al., 1995; Mathiews, 1992; Wiesenberg & Hutton, 1995). In this light, the new technologies have to be introduced in the classroom for pedagogical, social, financial and political reasons. This means that emphasis is placed on faculty as cultural intermediaries during the learning process in its new form, during which the social consequences of the new technologies must be constantly assessed.

A major theme of Vygotsky's (1978) theoretical framework is that social interaction plays a fundamental role in the development of cognition. He stated:

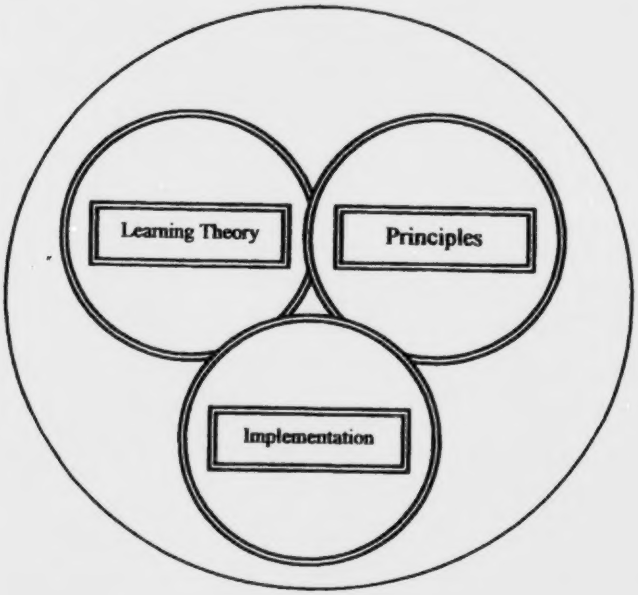
> Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals. (p.57)

A second aspect of Vygotsky's theory is the idea that the potential for cognitive development is limited to a certain time span, which he calls the "zone of proximal development." Furthermore, full development during the zone of proximal development depends upon full social interaction. The range of skill that can be developed with adult guidance or peer collaboration exceeds what can be attained alone.

Vygotsky's theory was an attempt to explain consciousness as the end product of socialization. For example, in the learning of language, our first utterances with peers or adults are for the purpose of communication; but once mastered, they become internalized and allow "inner speech." Vygotsky's theory is complementary to the work of Bandura (1977) on social learning and a key component of situated learning theory. Because Vygotsky's focus was on cognitive development, it is interesting to compare his views with those of Bruner (1990) and Piaget (1969).

A holistic approach to design of a pedagogical model is illustrated in Figure 1.

Figure 1
Designing a Pedagogical Model: A Holistic Approach



Basic Assumptions and Principles

The ADEC Guiding Principles for Distance Teaching and Learning (ADEC, 1996) emphasize the following basic assumptions and principles:

> *The principles that lend themselves to quality face-to-face learning environments are often similar to those found in Web-based learning environments.*
>
> *With all forms of media converging to a digital platform, advanced educational technology may include a variety of learning environments and information appliances.*
>
> *While rapidly emerging technologies offer unlimited potential for virtual learning environments for both face-to-face as well as distance learners, practical application of existing technologies may often prove highly effective for various audiences and objectives.*
>
> *The learning experience must have a clear purpose with tightly focused outcomes and objectives. Web-based learning designs must consider the nature of content, specific context, desired learning outcomes and characteristics of the learner. Learner-centered strategies include modular, stand-alone units that are compatible with short bursts of learning. Learning modules may also be open, flexible and self-directing.*

The learner is actively engaged. Active, hands-on, concrete experiences are highly effective. Learning by doing, analogy and assimilation are increasingly important pedagogical forms. Where possible, learning outcomes should relate to real-life experiences through simulation and application.

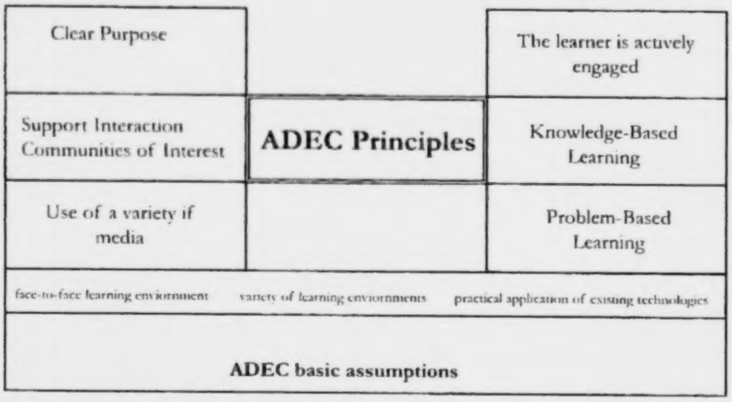
The learning environment makes appropriate use of a variety of media. Various learning styles are best engaged by using a variety of media to achieve learning outcomes. Selection of media may also depend on nature of content, learning goals, access to technology, and the local learning environment.

Learning environments must include problem-based as well as knowledge-based learning. Problem-based learning involves higher order thinking skills such as analysis, synthesis, and evaluation while knowledge-based learning involves recall, comprehension and application.

Learning experiences should support interaction and the development of communities of interest. Learning is social and sensitive to context. Learning experiences based on interaction and collaboration support learning communities while building a support network to enhance learning outcomes. Multiple interactions, group collaboration and cooperative learning may provide increased levels of interaction and simulation.

Figure 2 illustrates the above.

Figure 2
ADEC Basic Assumptions Principles


Clear Purpose
The learner is actively engaged
Support Interaction Communities of Interest
ADEC Principles
Knowledge-Based Learning
Use of a variety if media
Problem-Based Learning
face-to-face learning enviornment
variety of learning enviornments
practical application of existing technologies
ADEC basic assumptions

Steps and Methodology

The development of distance learning methodology requires a pedagogical approach designed to achieve the best possible results (Egan, 1991; Schlosser & Anderson 1994). This section presents the basic components of an alternative pedagogical model, which include the following (also see Figure 3):

- the development of a teaching methodology
- the delineation of a communication model
- the classroom architecture
- the selection of a technological infrastructure
- the design of an organizational and supporting model
- the evaluation methodology

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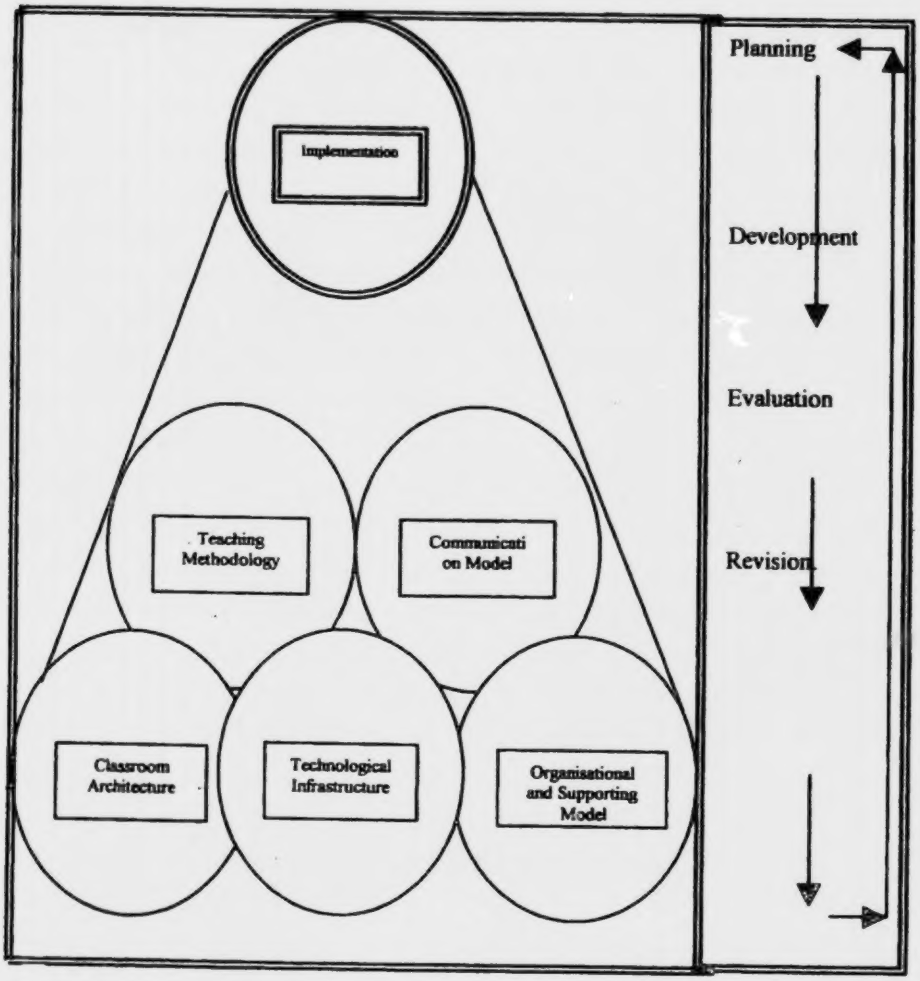
Figure 3
Pedagogical Model Implementation—
Steps and Methodology


Implementation
Teaching Methodology
Communication Model
Classroom Architecture
Technological Infrastructure
Organisational and Supporting Model
Planning
Development
Evaluation
Revision

The current pedagogical model follows the methodology of the Instructional Model (Dick & Carey, 1990; Gustafson & Powell, 1991), particularly the stages of planning, development, evaluation and revision.

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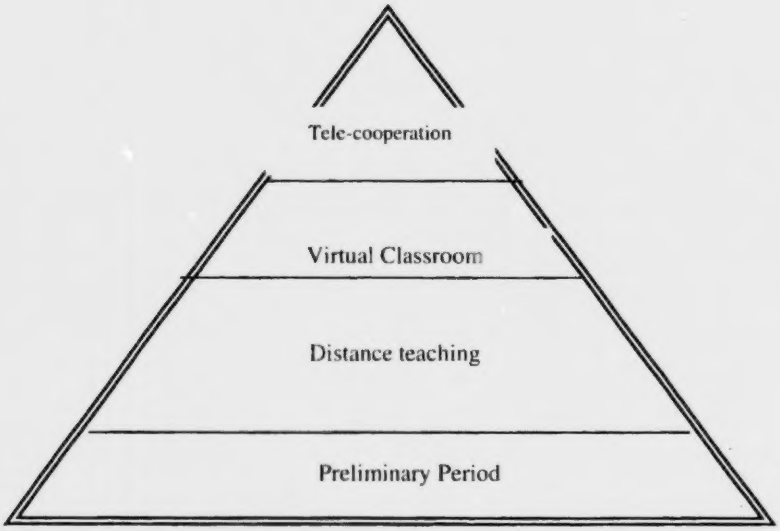
Development of the Teaching Methodology—Implementation Process

Students should be introduced to the new teaching model in stages, in order to become a part of the new learning environment as smoothly as possible (figure 4). This can be achieved through the implementation of the following:

- A preparatory period
- Distance teaching
- Virtual class
- Tele-cooperation

Figure 4
Stages of Teaching Methodology


Tele-cooperation
Virtual Classroom
Distance teaching
Preliminary Period

Preliminary Period. Based on the above methodology, the steps of the approach are described as follows:

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1. Preparation of university/college

- Provision of all the necessary technological means and applications
- Software
- Hardware
- Communicational status
- Networking of classrooms
- Hiring of specialized technical personnel in order to support the instructor on technical matters

2. Familiarization of faculty with the new reality

- Familiarization of faculty with the basic traits of the new learning environment. (new roles, pedagogical concerns, etc.)
- Seminars providing basic knowledge on computers and the Internet
- Familiarization with educational interactive multimedia
- Knowing how to use the required technological tools in order to implement the procedures of teleconferencing
- Psycho-pedagogic approach of the new environment
- Techniques of encouraging and supporting students

3. Preparation of students

- Introductory briefings on distance learning

- Familiarization of the students with hardware and software and educational multimedia
- Selection and training of one or more students as class motivators. These students will have the responsibility to motivate the other students to get involved in the learning process and to support the technical tools (mention and fix small technical problems, etc.) These *motivators* serve as the interface between faculty and students.

Distance Teaching. The effects on distance learning are as follows:

1. Description of the action

- The course is taught by the teacher of one class section and attended by both the students of his/her class and the teacher and students from another class section

- At a scheduled time the two classes will be ready for a joint teleconference, after which students in each class section are involved with discussions facilitated by their teachers in the conventional classroom. In this phase both teachers are involved in the classroom, in order to more easily integrate students into the practices of distance learning

2. Evaluation

- Faculty evaluate students' knowledge, experience from the learning situation

- Faculty note problems, ways of solving them, alternate procedure, etc.
- The procedures as a whole are evaluated by students and teachers
- All evaluations are made a part of a permanent record

Creation of the Virtual Classroom

1. Description of the Action

- The creation of a complete learning environment is attempted in this phase, in which the entire class period is conducted via teleconference and questions from both classrooms encouraged (discussion—exchange of ideas—other activities)
- At this point only one teacher is needed to manage the virtual classroom with the student motivator(s) active in the other classrooms

2. Evaluation

- Faculty evaluate students' knowledge, experience from the learning situation
- Faculty note problems, ways of solving them, alternate
- The procedures as a whole are evaluated by students and teachers
- All evaluations are made a part of a permanent record

Phase D: Tele-cooperation: Development of joint activities between teleclassrooms.

1. Description of the Action:

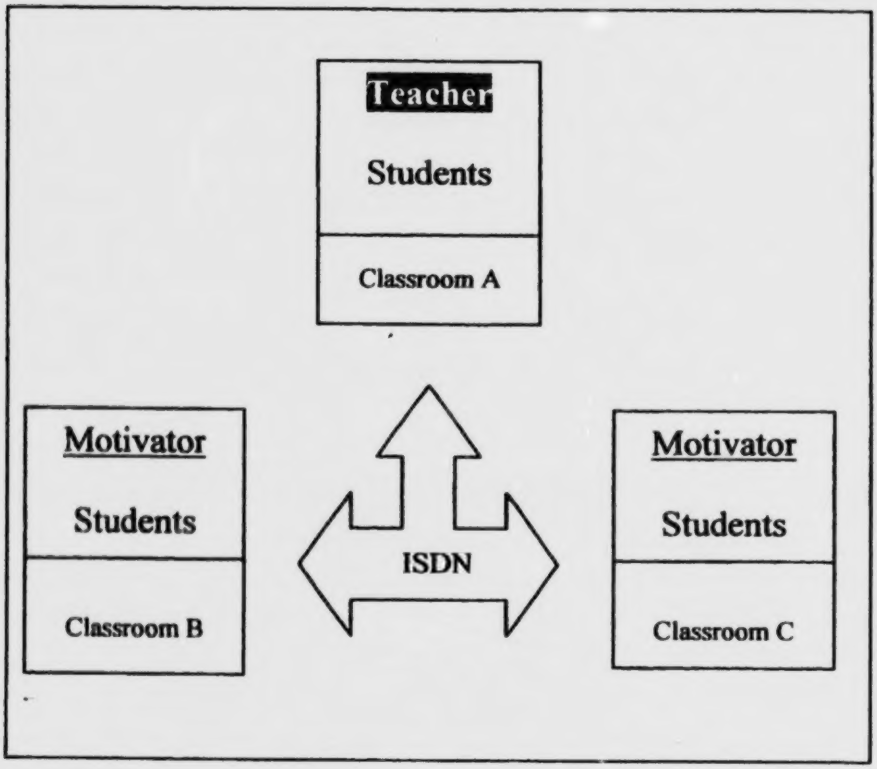
- In this phase an open, cooperative environment must be developed between the students of the two classes. Basically, it is an attempt to create a work group that will be in cooperation from a distance, in order to carry through a joint activity. During this phase, the students are the leading actors in the new collaborative environment, while the teacher and the motivators play a facilitating role.

2. Evaluation.

- Self-evaluation—evaluation of the procedures by the students
- Students note problems, ways of solving them, alternate approaches, etc.
- The procedures as a whole are evaluated by teachers

The Communication Model. The communication model is illustrated in Figure 5.

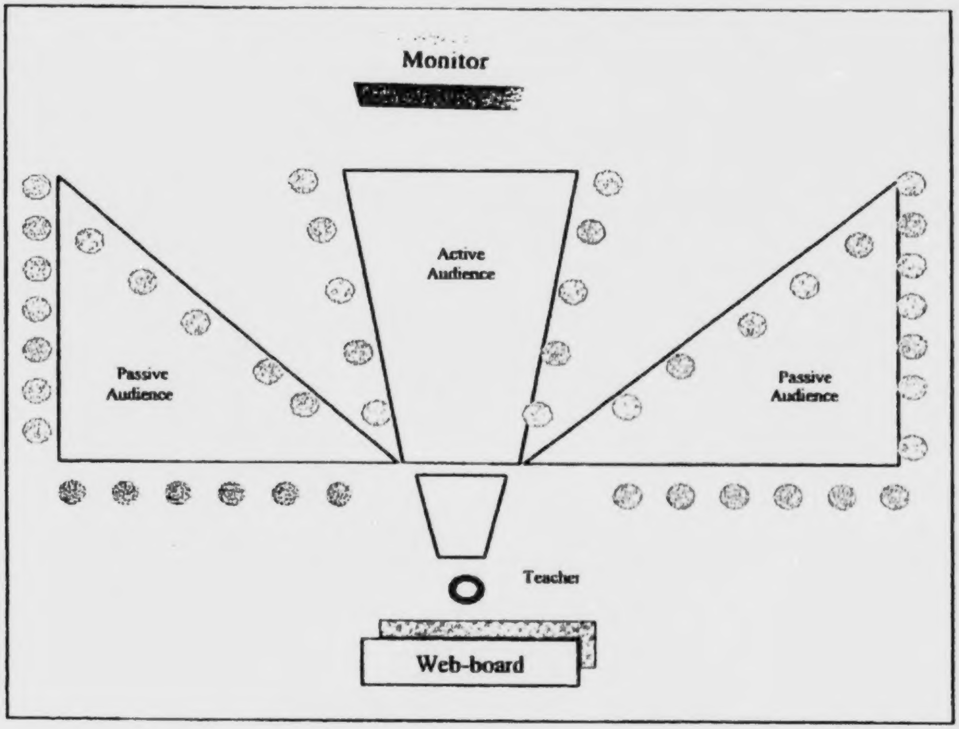
Figure 5
The Communication Model


Teacher
Students
Classroom A
Motivator
Students
Classroom B
ISDN
Motivator
Students
Classroom C

The Classroom Architecture Model. The aim of a distance learning methodology is to develop an interactive learning virtual space in which learning communities with common interests can collaborate "face to face." This is easy to manage with small sections (8-10 students). But what must be done to manage a medium or large group?

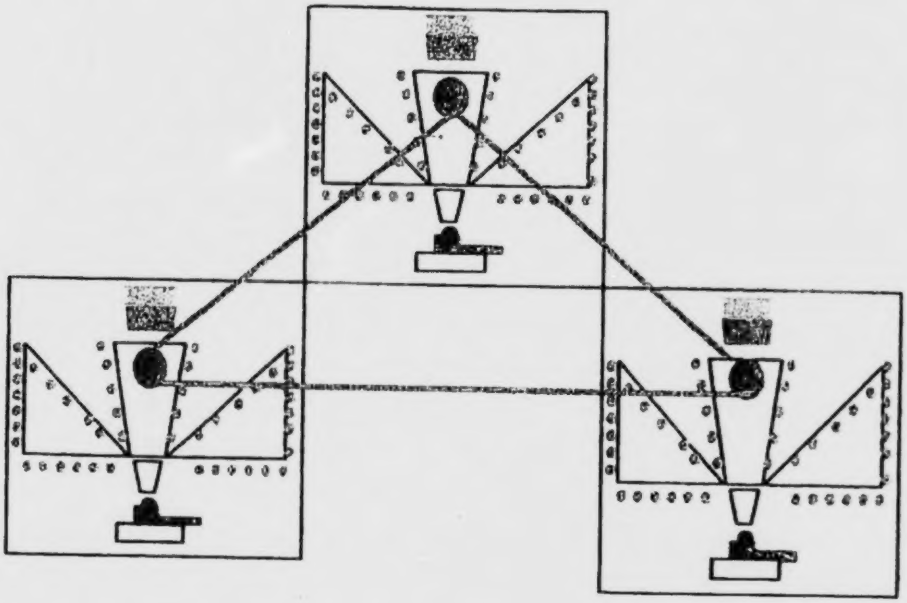
The methodology chosen is that of separating the audience into active and passive. The active audience consists of six to eight students who sit in a triangle on the top of which is the teacher (Anastasiades, 2002). The students of the active and passive audience alternate during the lessons, so that all the students of each class have an active role experience. This is illustrated in Figure 6.

Figure 6
The Classroom Architecture Model


Monitor
Active Audience
Passive Audience
Passive Audience
Teacher
Web-board

The conceptual convergence of the original model (IDE, 1996) with the separation of the audience into active and passive groups, forms a transitory approach of original methodology which from now on will be referred to as "Transition Methodology," and will be marked by the alternation of active and passive audiences as part of the model. Transition Methodology ensures equal participation of all the students of the class in the new learning environment. See Figure 7.

Figure 7
The Transition Methodology—
Interactive Learning Collaboration Area



The transition methodology of active and passive audiences has been implemented at ODUSSEUS project, and the results were sufficiently strong (Anastasiades, 2002) to warrant the development of a prototype class architecture model for higher education.

The Technological Infrastructure. The technological model per class is supported by three ISDN lines, one dial up Internet connection, Webboard and a teleconferencing system, which includes one TV screen, an interactive camera, one video recorder, one PC system and one telephone appliance. See Figure 8 and Table 1.

Figure 8
The Technological Infrastructure

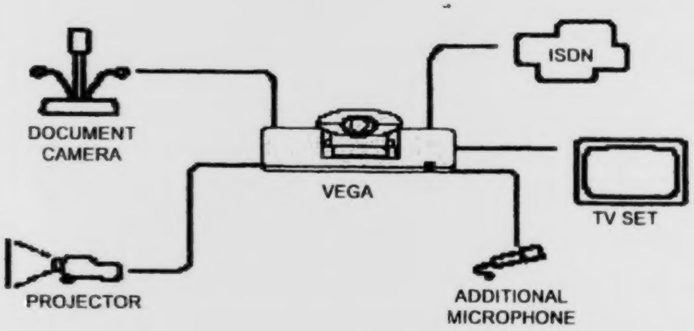


Table 1
Suggested Technical Specifications

SUPPORTED STANDARDS, ITU-T H.320: ISDN, leased networks
Video: H.261, H.263, Audio: G.711, G.722, G.728, Data: T.120 115200 kbps rate
Proprietary protocol, MCU compatibility: H.243
FEATURES
Bit-Rate: 56÷384 kbps over ISDN, 56÷384 kbps over V.35 (/L), Channel Aggregation: 384 Bonding
Frame Rate: 30 fps, Video Resolution: FCIF 352x288 pixels, QCIF 176x144 pixels 4CIF 704x576 pixels, for still images (Annex D)
Camera remote control: H.281
Audio Coding Band Bit rate, G.711 300÷3400 Hz 56 kbps, G.722 50÷7000 Hz 48/56 kbps G.728 50÷3400 Hz 16 kbps,
AUDIO FEATURES: Echo cancellation, Full Duplex, Automatic Gain Control (AGC) ± 12 db, Automatic Noise Suppression
CAMERA: Type: 1/3" colour CCD, High-speed powered camera (80°/sec), 4 preset positions
Optics - ZOOM x 12 5,4 68,4 mm F 1,8 ÷ 2,7
MONITOR REQUIRED PAL format, Single monitor, PIP function
ADDITIONAL FEATURES
Internet access through the "ISDN Modem" feature by means of external PC as an alternative to a videoconference session (VEGA), T.120 infrastructure for multimedia over data channel by means of external PC, VideoInterphone (VIP) function for call transfer to a standard analog telephone.

The organization and support model. The organizational and support model constited of three committees. The Monitoring Committee represented the participating institutions and had oversight responsibility for the project. The Research Committee was responsible for planning and implementing the project. Finally, the Organizational Committee played a general supporting role.

CONCLUSIONS AND RECOMMENDATIONS

The introduction of new learning technologies constitutes a decisive factor for the preparation of tomorrow's citizens who will be called upon to respond to the challenges of the emerging Information Society. The introduction of the these new tools in educational systems not only requires finances for the provision of the equipment and software. The central point of the endeavor is the search for a complete and multilevel system that will clearly define the principles, the steps, the procedures, the means and the methods required for successfully integrating these technological tools into the learning environment. The development of sound pedagogical approaches must be an integral part of this entire approach.

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DELIVERY OF COURSEWARE

USING CD-ROM MEDIA

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INTRODUCTION

The use of paper as a medium for delivering course materials to students in universities and colleges has become outmoded, is very limited in scope, and is relatively expensive. However research shows it is still very widely used and very popular. Students today rightly demand high quality from their educational experience and courseware content and presentation is therefore paramount. Computer Assisted Learning (CAL) enhances courseware delivery enabling academic staff to provide high quality, stimulating, and interactive courseware resources, that are far superior to paper.

Modern computing and communication technologies and the use of Web technologies and CD-ROMs are particularly appropriate in this respect. A CD-ROM provides a medium that is simple and easy to use, familiar to students, cosmetically pleasing, has large capacity, can facilitate the use of Computer Assisted Learning technologies, and result in significant cost savings. At the same time it can improve the quality of the material delivered.

This paper suggests that using CD-ROMs based on Web technologies and other advanced Computer Assisted Learning packages to deliver high quality courseware, offers a significant range of advantages over existing paper systems and is essential for delivering modern academic programs in colleges and universities It proposes a suggested format for the presentation of CD-ROM courseware and a management structure of the materials, and outlines the development of a wizard to automate the production process and make it simple and easy for academic staff to use.

COMPARISON OF DELIVERY MEDIA

Traditional Lecture Notes

For many years paper has been the main, and often only, delivery medium for lecture notes. Paper has many positive attributes which explains its popularity and longevity as a medium. Today, paper-based notes are usually printouts of word processed material (e.g. using Microsoft Word), or copies of slides from electronic presentations (e.g. using Microsoft PowerPoint).

The advantages of a paper system are:

- notes are quick and easy to implement and to change
- staff and students are familiar and comfortable with this approach
- notes are portable and can be brought to lectures and further annotated by students
- reading from paper is natural and can be done at an individual pace

The disadvantages of such a system are:

- very expensive to produce
- often ties up academic staff who produce piecemeal photocopying
- heavy and bulky

- low capacity
- environmentally unfriendly
- no scope for high tech facilities, e.g. multimedia, audio, video, animation, Web hot links, support resources

CD-ROMs

CD-ROMs, used in conjunction with modern software packages and Web technologies, offer an inexpensive way of providing students with high quality state of the art courseware. They provide the means to use such new technologies as multimedia audio and video, electronic presentations, hot links to Web resources, and interactive learning packages, to produce innovative and enhanced high quality teaching materials.

The advantages of a CD-ROM system are:

- very inexpensive offering huge cost savings to college and university departments
- high capacity
- small, light and portable
- can use a range of multimedia and interactive packages
- high-tech look and feel—magazines and books use CDs extensively, therefore they're familiar

The disadvantages of such a system are:

- students initially unfamiliar with this type of courseware delivery medium
- needs a computer in order to access material
- high expectation of quality of presentation
- all courseware material, suitably proofed, needs to be ready at the beginning of the course

- errors cannot be changed once CD-ROM is produced
- electronic book considerations—must use new IT (e.g. multimedia, interactive, etc).
- means of mass production—time and cost of professional machines
- skills needed by staff to produce courseware material in this format

FORM AND QUALITY CONSIDERATIONS

Students have been active users of CD-ROM technology for over 10 years. CD-ROMs have been given away free with magazines containing anything from free software to video clips. To be successful in distributing college courseware in this form it is necessary to ensure that the material produced meets not only the information content required but also the high quality cosmetic appearance and usability expectations of the users. (Edgar-Nevill, 2000).

As a result of earlier work at the University of Lincoln (2002) to develop a CD-ROM to support an undergraduate HTML and Web Design course (Edgar-Nevill, 2001a), the following levels of sophistication were identified:

Level 1 ***Directory Dump—***
straight copying of files onto the CD-ROM.

Level 2 ***Indexed Dump—***
HTML Web page front-end index with hyperlinks to individual files.

Level 3 ***Standardized Format—***
standard presentation format and standard structure.

Level 4 ***Extended Usability Format—*** *inclusion of auto-loading facility (Browsercall 2002), interactive materials, comprehensive internal and external integration using Web hyperlinks. Index improved cosmetically by using a Java applet (Slicktree 2002).*

Level 5 ***Professional Format—*** *extend browser interface to include professional graphics.*

Expectations of students are very high. It is not until Levels 3 and 4 are reached that the real value of distributing courseware materials in this form is realized. Quality issues lie at the center of problems in the expansion of the use of CD-ROM materials.

From the faculty viewpoint the problem can seem insurmountable. Faculty look at a professionally produced CD-ROM, perhaps with a limited understanding of the underpinning technology, and conclude it would be nice to do, but beyond their capabilities. Another conclusion might be that the high cost of producing such a product makes it uneconomical. It is exactly these concerns that are addressed in this paper by proposing the development of a wizard to help automate the production of a Level 4 CD-ROM for a given set of courseware materials.

This begs the question—*Why Level 4 and not Level 5?* In many ways Level 4 and Level 5 are at either end of a greyscale of sophistication compared to the quantum leaps of the previous levels. As the wizard itself develops, the level of CD-ROMs produced will develop, but there has to be a realization that the price paid for regimenting development in this way is high and limits the range of materials one might want to distribute in this form.

CD-ROM DEVELOPMENT WIZARD

The wizard under development produces CD-ROMs using a very simple information management regime (Figure 1). Formats used in applications already developed are summarized in Figure 2, which shows the logical structure of information in the index of one example CD-ROM (Brighouse, 2002).

Figure 1
CD-ROM Structure

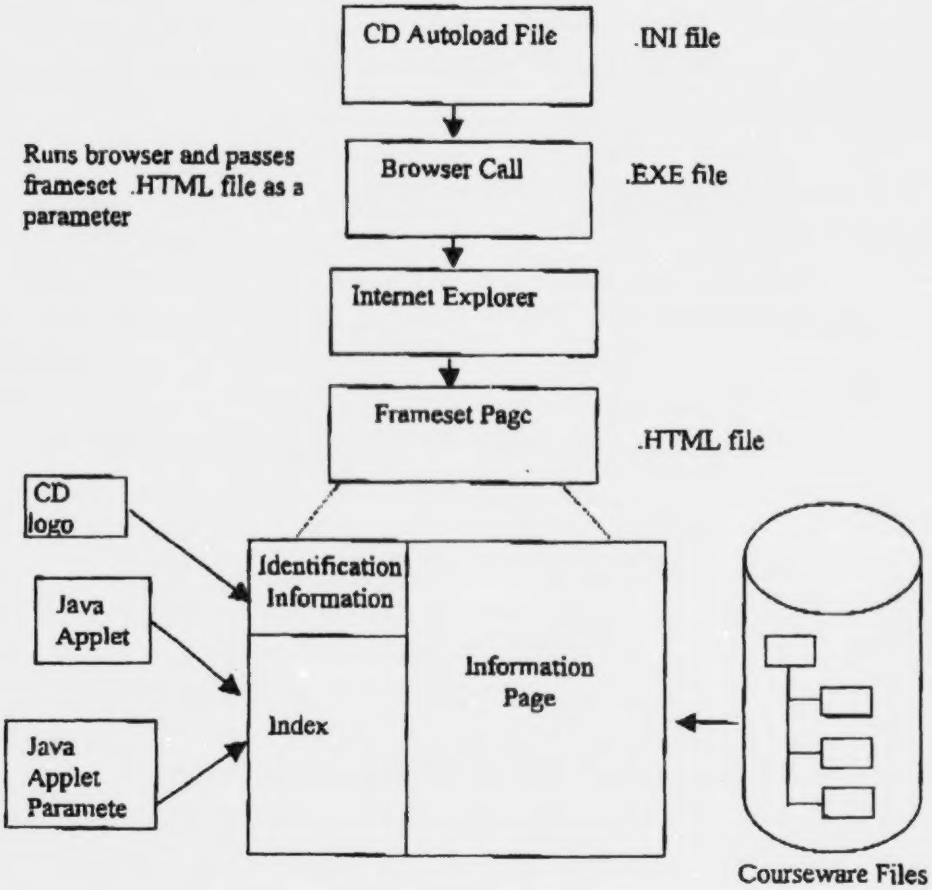
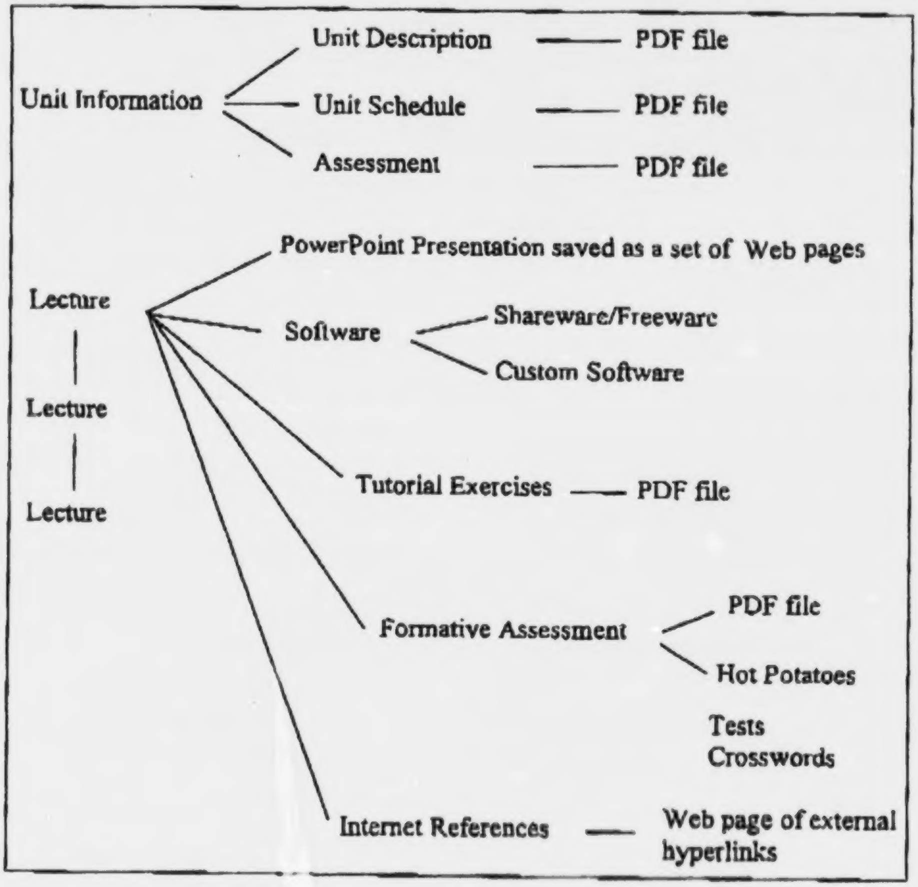

CD Autoload File
.INI file
Runs browser and passes frameset .HTML file as a parameter
Browser Call
.EXE file
Internet Explorer
Frameset Page
.HTML file
CD logo
Java Applet
Java Applet Paramete
Identification Information
Index
Information Page
Courseware Files

Figure 2
Logical Structure of CD-ROM Contents

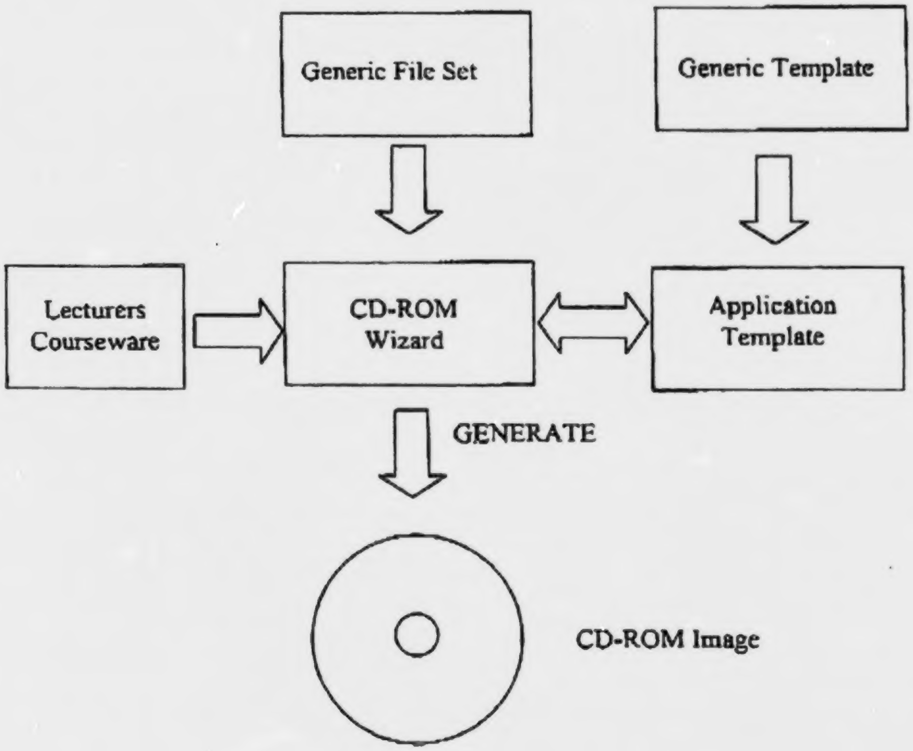

Unit Information
Unit Description
PDF file
Unit Schedule
PDF file
Assessment
PDF file
Lecture
Lecture
Lecture
PowerPoint Presentation saved as a set of Web pages
Software
Shareware/Freeware
Custom Software
Tutorial Exercises
PDF file
Formative Assessment
PDF file
Hot Potatoes
Tests
Crosswords
Internet References
Web page of external hyperlinks

One important consideration is that the CD-ROM format must be able to hold anything found on a Website containing materials. Another important aspect of this technology is to avoid the expense and waste of students printing the contents of courseware Websites on paper (INTELLECT, 2000).

There should be no restrictions on the format of linked materials. It is, however, important to remember that for the CD-ROM to be as self-contained as possible, it should depend on as few external pieces of software as possible (Edgar-Nevill, 2001b). For example, if documents are stored as Microsoft Word files, students using them must have Microsoft Word or a viewer installed on their home machines. It is for this reason that Adobe Acrobat PDF files (Adobe, 2002) have gained such popularity and have become an international standard.

The outline Wizard structure is given in Figure 3. For a given application a plan is produced interactively with the faculty identifying links to files and information sets to be included. When this process is completed the CD-ROM image is built using standard files (e.g. autorun, Java Applet, Frameset etc), tailored standard files (e.g. Java Applet parameters for the index) and the faculty member's own courseware files. The wizard is currently being extended to allow for a wider range of customization features.

Figure 3
CD-ROM Wizard


Generic File Set
Generic Template
Lecturers Courseware
CD-ROM Wizard
Application Template
GENERATE
CD-ROM Image

CONCLUSIONS

"People like paper." There is no getting away from this, it is still widely used and very popular. It is a familiar old friend that has served us all well in the past. However, as a delivery medium for academic courseware it is both limited and expensive, and cannot, on its own, meet the demands for delivering high quality courseware. Modern Computer Assisted Learning packages and Web technologies provide the means for greatly enhancing the quality and scope of courseware presentation, providing powerful multimedia and interactive learning environments with extensive help and support materials.

CD-ROMs provide a high capacity, inexpensive medium for presenting courseware material that allows students easy access, without the expense of linking to the Web. Consequently, it is worth persevering to attempt to wean staff and students away from paper and to consider CD-ROMs as a significant move forward. To make it easier and encourage staff to create and use CD-ROM resources, a standard format and structure is proposed, and a production wizard is under development.

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LESSONS LEARNED
FROM BLENDED BIOLOGY CLASSES

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INTRODUCTION

A search for blended courses on the Web resulted in courses that integrated two or more subjects and degree programs in which the courses were blended from different disciplines. There were even blended lecture-laboratory courses. But most were courses where part of the course was online coupled with an in-class component.

The majority of the blended courses were for professional training or certification in the fields of business, business management, marketing, teacher education, engineering, and computer science, and for religious instruction. Very few academic courses were identified and how the word blended was defined was not always clear. There may be many academic courses that are now blended but are not labeled as such. In a survey of papers presented at the 13th International Conference on Teaching and Learning (www.teachlearn.org) less than 10% were in Track 1 (Learning Communities/Blended Courses) and all but a few of these were on learning communities.

This paper addresses experiments with different types of blended courses in teaching biology. While all courses had an online component, they ranged from online augmentation of an existing course with no release from class to an on-campus course combined with an online course studying the same subject.

DISCUSSION

Biology Laboratory. Each fall 1,600 students enroll in Virginia Tech's introductory biology laboratories. Because of monetary constraints resulting in fewer graduate teaching assistants, increased enrollments and no additional teaching space, biology laboratory sessions have been reduced from three hours to two hours per week. This reduction in class time has placed additional constraints on the graduate teaching assistants as they had already been having difficulty covering the material while still providing time for students to have hands-on experience.

To make the most of in-class time, in Fall 1999 student materials were placed in an online laboratory manual. Students had to review course material and take a pre-class quiz before they could download worksheets that they needed to bring to class. Based on in-class observations and graduate teaching assistants' interviews, the online manual have improved the students' knowledge of basic concepts and less time has been used in class explaining these concepts. Students have been asking more questions in class, have become more involved in discussions, and have kept more focused on the topic when in class.

Honors Biology. Approximately 35 students a year enroll in Honors Biology. This non-lecture course emphasizes problem-solving and critical thinking skills. While there are reading assignments in the linear sequence of the textbook, students are expected to use whatever material is necessary to answer questions.

Each Monday, students are in assigned chat rooms addressing questions posted by themselves on the assigned topic and a question posted by the professor. These chats are monitored by tutors who have previously taken this class. By Tuesday evening of each week, one student in each group must summarize the two chats and post summaries on the Web.

Each Wednesday the professor peruses the summaries and decides if there is anything appropriate to bring up in class. If not, students spend class time thinking critically about other questions that they can download from the Web site, or about new questions the professor finds while reading professional and lay magazines or watching television. Each Friday, students listen to invited speakers, half of whom are not scientists but who have a connection to biology. They include philosophers, artists, poets, theologians, historians, etc.

"Examinations" are open-book, take-home experiences in which students are challenged with such tasks as designing a new 64 cell organism that can survive and sexually reproduce under certain environmental conditions, or identifying structures or functions to eliminate harmful blue-green algae, or design a city using concepts from evolution and ecology. Or they may be reinterpreting biological ideas into art, poetry, music or dance.

Because these students are Honors students, grades are not a good measure of this teaching style because most students do very well. However, the impact is best summarized by an unsolicited e-mail from a former student who said:

> *The formative experience that directed me to pursue science was an honor's biology class I took at Virginia Tech. What made it so important was that it focused as much on the experience of being a scientist as it did on the topic of biology, a technique sometimes referred to as inquiry-based learning. Before taking that class science was just something that was fun, not a topic to be*

> *passionate about. I think that transformation is a vital one to training the next generation of scientists. I hope to do the same for potential students in my career as a researcher and teacher.*

In the professor's teaching evaluations, another student said:

> *His goals are to get students to apply their knowledge to things in biology they will have to deal with once they have graduated from Virginia Tech. His class was very stimulating.*

Principles of Biology Trailer Course. This course began with 40 students and approximately half were repeating the course because they received a D or F in a regular biology lecture section. Six students dropped the course late in the term because they did not like the approach or they were still receiving D or F grades. This class had no lectures and students were given considerable responsibility to learn by themselves or in small groups. When the professor announced he was not going to lecture in class, ten students made a point of stopping by and saying "thanks for not lecturing."

The class was split in half and students were asked to attend only one class a week to discuss their results and address concerns. Students were assigned two online modules addressing critical issues in biology (Buikema, 2002). The modules were based on teaching content in context and learning was non-linear. The two modules were on "Cheetahs, an Endangered Species: Can and Should they be Saved?" (Buikema, 1999) and "Water, Why should we Care?" (Buikema, 2000). Instead of examinations, the students wrote two papers on the questions posited in the module titles.

The grade distribution for this class was: A (24%), B (46%), C (24%), D (3%) and F (3%). For traditional lecture classes the grade distribution was lower: A (16%), B (30%), C (16%), D (14%) and F (7%). If it's assumed that the six students who dropped the course were in the D and F range, the distribution of A, B, C, D and F grades would change to 21, 38, 21, 10 and 10%, respectively. There were the same number of D and F grades, but more A and B grades and less C grades than would have been predicted.

When student pathways through the modules were mapped, some students were very methodical while others wandered through each module. In all cases the students completed the assignments. When asked about their journeys through the modules, students typically started in an area they were most comfortable or knowledgeable and as they learned more they moved on to other areas where they were less knowledgeable.

Principles of Biology/General Biology. During Summer 1998, this course was taught simultaneously to 27 on-campus and 15 online students. The online students were located as far away as New York, Florida, and Louisiana.

On-campus the class met on Tuesday, Wednesday and Thursday, and attendance was not mandatory. The on-campus sessions started with a short 20 minute lecture using a concept map and the remaining class time was spent on problem-solving and critical thinking exercises that were available on the Web. The goal was to help students develop the skills and knowledge they might need to answer the online question of the day.

All students had to complete four online assignments a week. Three assignments could not be accessed until each student took a quiz to demonstrate that they had mastery of the assigned material. Students received immediate feedback on the quizzes, but the scores were not used to determine course grades. After taking a quiz, students accessed an essay question that needed to be addressed and submitted online before a deadline. After the deadline, the computer locked the folder so late work could not be submitted and simultaneously opened the folder under a different name so students could see an "ideal answer" and a view answers submitted by their colleagues.

Once the assignments were graded, papers with a grade of 90% or higher were noted with an asterisk. The intent was to show students that there are many solutions to a problem. Three essay examinations were also given online and these were treated much like the daily exercises.

The fourth assignment typically involved two on-campus students and one off-campus student working online in a "research team." This assignment lasted the full six week term, and students were given guidance about what tasks had to be completed each week. Prior to being assigned to a research team, students were given a choice of 20 general research questions and they were asked to select their top three choices. Once students were assigned to an area of interest each team was presented with the full question and they had to work online to design an experiment to answer that question.

The final course grades were higher than would be predicted from the grade distribution from a traditional class. The final grades for this class were A (26%), B (43%), C (19%), D (2%) and F (10%). The grade distribution for all students taught by traditional lecture were A (16%), B (30%), C (33%), D (14%) and F (7%).

Three on-campus students complained about this course to the Dean. (These are *real* complaints.) Two complained that the professor was trying to make them think. They wanted to take examinations based on memorization. The other student complained that even though class attendance was not mandatory, she felt she would miss something if she did not attend and this was interfering with her free time.

CONCLUSIONS

In summary, blended courses offer much freedom to the professor and student. More class time is spent on the assignment or working on problem-solving and critical thinking skills. Class participation in the blended courses reported in this paper was much higher and grades tended to be higher than those earned in traditional classes.

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EVERYTHING I EVER NEEDED TO KNOW I LEARNED IN SEMINAR 101: ORGANIZING THE FIRST YEAR FOR DYNAMIC INTERACTIVE LEARNING

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INTRODUCTION

The First Year of College

During the past 25 years, colleges have increasingly incorporated a special course for entering students, designed to enhance their first-year experience. Outcomes and renditions for these courses vary greatly, but the roadmap of the first-year experience often includes common elements—learning communities, critical thinking, active learning, information technology literacy, problem-based learning, group collaboration, and team building. Educators developing curricula for first-year courses are challenged by the fact that first-year students who may be well adapted to high school learning environments are not as often prepared for college work.

Questions that may arise as educators develop the curricula for first-year programs include: *How does the course fit into the University curriculum? Where does the course designer start? Why does it have a positive impact on students? How can technology facilitate the intended learning outcomes? How can a first-year seminar with an* *established core curriculum be combined with technology to, as Chef Emeril Lagasse likes to say, kick it up a notch?* (Lagassee, 2002).

First-year courses, if they are designed based on the growing body of educational and psychological research, have an amazing potential to set the stage for a successful college career. As two students who participated in a special program for first-year students at Western Washington University stated:

> *I started asking questions. Real questions...I have gained the motivation to think.*
>
> *Before the ... class, literacy just meant to me that you can read and write. But now I realize that literacy is more than that; it is talking, listening, thinking, researching, and how you interact with the world.*
> (Western Washington University, 2002)

What follows is the theoretical background for—and curricular structure of—the first-year experience at Western Washington University, as well as two case studies of first-year seminars that guide students on an intellectual journey of discovery about themselves, their learning, and their university environment.

Making the Case for the Course

A growing body of evidence supports the outcomes of the first-year experience to improve retention and academic performance (Cuseo, 2002). In their exhaustive review of more than 2500 post-secondary studies examining how college affects students, Pascarella and Terenzini (1991) stated that "The weight of evidence suggests that a first-semester freshman seminar designed to orient the student to the institution and to teach important academic survival skills is positively linked with both freshman-year persistence and degree completion" (pp. 419-420).

Results of the research have paved the way for a trend among institutions of higher education. The 2000 National Survey conducted by the National Resource Center for The First-Year Experience (2002) reported that over three-quarters of responding institutions offer a special course for first-year students. In 1999, Western Washington University recognized the value of such an option and piloted a program based upon the First-year Interest Group program at the University of Oregon.

Fitting the Course into the Curriculum

Western Washington University's First-year Interest Groups program is revised yearly based on both programmatic and student learning outcome assessment. First-year students co-enroll in two larger sections of general education courses and one small, two-credit seminar. Each three-course cluster is themed according to the academic disciplines that comprise the general education courses. The seminar course provides the space to explore the theme in more detail, creating a learning community environment in which students make connections to their professors and peers, examine disciplinary perspectives across different fields of study, and gain knowledge of how to gauge themselves as learners.

Motivated Strategies for Learning

In Western Washington University's program, the seminar curriculum is focused on students acquiring skills in learning to learn. One activity in the seminar is based on the work of Bill McKeachie, who pioneered the first

Learning to Learn course at the University of Michigan (Pintrich, et al., 1987) and who, along with Paul Pintrich, developed the Motivated Strategies for Learning Questionnaire (Garcia & Pintrich, 1996). The purpose of the Motivated Strategies for Learning Questionnaire is to gather information about students' study habits, learning skills, and motivation for schoolwork (VanderStoep & Pintrich, 2003).

Seminar instructors were encouraged to use the Motivated Strategies for Learning Questionnaire as a way to reveal students' strengths and those areas in which they could improve. Hofer, et al. stated (1998) "There are a number of different models of self-regulated learning…but all have in common the basic assumption that students can actively regulate their cognition, motivation, or behavior and, through these various regulatory processes, achieve their goals and perform better" (p. 57). By focusing on students' learning qualities as skills and providing carefully constructed learning opportunities, students are often motivated to improve those skills.

FIRST-YEAR SEMINAR CASE STUDIES

Designing the Course

During the Fall 2002 program at Western Washington University, two first-year seminar instructors for the course clusters "Messages from the Jungle" and "The American Dream" added some unique features to the seminar designed to:

- Motivate students to think critically and learn actively while constructively building knowledge
- Develop students' skills in information technology, collaboration, peer review, and

team building as they participated in a group project

- Extend learning beyond the classroom using Web technologies (Palloff & Pratt, 1999)

By using these features to support the learning community approach of the seminar, the instructors hoped to create a transformative experience for the students (Mezirow, 1990). As Palloff and Pratt (1999) have indicated, "The goal of transformative learning is to understand why we see the world the way we do and to shake off the constraints of the limiting perspectives we have carried with us into the learning experience" (p. 129). This self-reflective process enables students to see beyond specific learning objectives and apply their new knowledge and thinking skills to situations beyond the classroom.

Building Community

Learning communities are created when classes are linked or clustered during an academic term, often around an interdisciplinary theme (Evergreen University, 2002). The seminars were designed to promote a community of learners who can support one another in collaborative group work, discussions, and experiences outside the classroom. Each of the instructors in the two seminars used the learning community model to help foster students' academic success and intellectual development. As Carl Bereiter (2002) of the University of Toronto's Centre for Applied Cognitive Science has stated:

> The most promising new developments in education involve restructuring school activities and discourse so that they resemble in some fashion the workings of research groups—where real questions are being

> investigated and students are trying to contribute to progress on those questions. (p. 20).

Hannafin, et al. (1999) described student- or learner-centered designs as open learning environments in which the learning is achieved and/or pursued in several ways, including immersion in a problem-based project or student-generated projects set against a real-world backdrop. Consequently, students in these environments engage in such projects with genuine motivation to build knowledge and community. Table 1 describes the seminars.

Table 1
Case Study Comparison of First-year Seminars

	Case Study #1: ***Messages from the Jungle***	**Case Study #2:** ***The American Dream***
Linked General Education Courses	Introductory Psychology Introductory Biology	Introductory Psychology Sociology of Gender
Open Learning Environment	Problem-based learning provided by instructor	Research issues generated by student inquiry
Purpose of Group Project	Students developed persuasive arguments opposite to their initial positions on whether the great apes possess culture and use language	Group project modeled after research in the disciplines of linked courses, including a literature review, survey and analysis of results
Unique Features	Students attended two field trips—one to the Chimpanzee and Human Communication Institute at Eastern Washington University, and one to the Woodland Park Zoo in Seattle, Washington	Students generated research topics during class discussion and groups were assigned research topics based upon students' interest areas. Each group member held a unique well-defined role (project manager, etc.).
Knowledge Building with Instructional Technology	Knowledge construction using electronic forum based on research hypotheses provided by instructor	Knowledge construction using electronic forum to collaborate and generate group research reports
Ultimate Product	Publication of class monograph	Professional-style poster presentation

The Role of Technology

Over 90% of students at Western Washington University live on campus their first year, but their hectic and varied schedules still made it difficult to meet face-to-face at times other than their scheduled seminar (which only met for two hours once a week). For this reason, the instructors created an online forum for each seminar to help facilitate the group projects. The two seminar instructors used YaBB, an open-source Internet forum that is available free to the public (XNull, 2002). One of the benefits of the program is that it is easily modified: each instructor was able to customize the forum to meet the individual seminar's needs (again, see Table 1). As James Van Belle (2002) has stated: "Creating and promoting online community can enhance the learning experience of students, open doors for educational possibilities that did not previously exist, and promote active, constructivist learning" (p. 197).

Student comments about the use of instructional technologies in the seminars that were obtained in a mid-course formative assessment included the following.

> *I think it's helpful and will prepare us for our future in college.*
>
> *The use of instructional technologies is very useful and encourages me to be involved in the class.*
>
> *I like how assignments are posted on the Web and how we can communicate with our group members.*
>
> *[The Collaboration Tools are a] good idea for groups to work together off of class hours.*

CONCLUSIONS

First-year students who may be well adapted to high school learning environments are not as often prepared for college work. Guiding them on their intellectual journey during a first year seminar can help provide them with the skills and motivation necessary for college success. Emerging Web-based collaborative technologies can enhance and extend structured learning activities. These instructional technologies can help kick it up a notch, even in a program that is overwhelmingly comprised of residential students. In this learning community setting, students may discover what they need to know in order to become successful learners, thinkers, technology users, and problem-solvers.

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TEACHING TECHNOLOGY IN AN ONLINE, DISTANCE EDUCATION ENVIRONMENT

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INTRODUCTION

There are numerous challenges inherent in teaching technology classes. These challenges are further exacerbated when teaching in an online distance education environment. The goal of this paper is to identify and analyze some of the challenges and then evaluate some approaches that have been used in teaching in this environment. The authors have taught and been students in online, technology courses for many years. They have both developed and adapted the research of others to create a number of practical techniques to meet these challenges.

The first part of this paper will discuss the challenges inherent in teaching technology-intensive course material. It will then move into a discussion of teaching in an online environment. The two topics will then be merged in a discussion of how the authors met the challenges in teaching a number of undergraduate and graduate classes online.

TEACHING TECHNOLOGY

The term and concept "learning" has a large number of definitions and interpretations. Some, for example, distinguish learning on the basis of level of cognitive engagement (Bloom, 1994; Bloom, Engelhart, Furst, Hill,

& Krathwohl, 1956; Piaget, 1954) while others focus on the type of activity in which the learner engages (Smock, 1981; Zimmerman, 1981), and still others on the learner's preferred approach to the task (McCarthy, 1991; Riding & Grimley, 1999). For the purposes of a discussion on teaching technology courses in an online learning environment, Mezirow's (1991) classification of learning across three dimensions of reflection—content, process, and premise—seems particularly appropriate.

Levels of Reflection in Learning

Content Level Reflection. This type of reflection entails acquiring facts and building skills. In a technology course such as a multimedia systems course, this level of learning would include topics such as discussing the characteristics of various graphic file formats and video CODECs, and developing skills such as using authoring software to create a product that incorporates voice-over narration and streaming video. Didactic instruction supported by modeling and texts, guided laboratory sessions, has proven effective for promoting learning at the content reflection level.

Process Level Reflection. This type entails developing problem solving ability. In the multimedia systems course mentioned above, learning at the process level of reflection would include selecting the appropriate graphic file format or video CODEC to use in a given application. Inherent in that selection process would be an understanding of the strengths and weaknesses of each alternative and an in-depth appreciation of the requirements for the application.

The tools for promoting learning at the process level of reflection are neither clearly identified nor universally accepted; the specific tools to develop the necessary critical thinking and problem solving capabilities are not, unfortunately, easily identified. There are, however, some general goals for learning within this level of reflection, including organizing knowledge, building upon prior experiences, developing problem-solving strategies, and engaging in hindsight analysis (Walker, 2000).

Constructivism is a widely accepted learning theory that offers significant insight into the means of facilitating the development of the problem solving capacities inherent in process level reflection. Constructivism is a learner-centered approach that emphasizes the importance of the active involvement of the student in the building of knowledge by integrating new information with his or her existing experiences (Niederhauser, Salem & Fields, 1999).

The theory underlying constructivism (Vygotsky, 1986) focuses more on the environment in which learning can occur than on any particular pedagogical technique. It is vital to create a context in which learning can occur (Hill, 1999). For technology courses, that context should be problem-centered and activity-based. Multiple tools and resources that the learner can manipulate and use for exploration are important, as is support for reflection and self-assessment. In effect, the environment should provide a firm foundation for scaffolding learning through coaching, modeling, and a forum for sharing problem solving strategies.

Premise Level Reflection. This level, representing the most cognitively demanding learning, entails an analysis and evaluation of the value and relevance of the subject matter. Referring back to the multimedia systems course, knowing when and why to use, or not use, voice over narration or streaming video—or any media enhancement at all—would be inherent in learning at the premise level of reflection

The ability to accurately assess value and relevance is typically developed only over time and as a result of life experiences. In technology courses, this type of longitudinal learning is usually promoted through collaborative projects. The value of collaboration as a tool to promote rich learning opportunities is well recognized (Collins-Eaglin & Karabenick, 1997; Daggs, Styres & Turner, 1997; Morgan, Whorton & Gunsalus, 2000) as is the importance of reality-based projects (Hakkarainen, Muukonen, Lipponen, Ilomaki, Rahikainen & Lehtinen, 2001). A review of both undergraduate and graduate catalogs from schools offering technology-intensive curricula such as engineering, computer information systems, and computer science clearly establishes the value of collaborative projects.

Summary. In summary, as seems to be the case with all educational activities, there is little that can be said with absolute confidence regarding teaching technology courses. There are, however, a number of generalizations supported by both research and experience. These generalizations are summarized in Table 1.

Table 1
Techniques for Teaching
Technology-Intensive Courses

Level of Reflection Examples	Pedagogical Approach
Content	
Acquisition of facts	Lecture, textbooks
Building skill	Guided laboratory, modeling
Process	
Organizing knowledge	Problem-centered context
Applying experience	Multiple tools and resources
Solving problems	Coaching, modeling, sharing
Hindsight analysis	

TEACHING ONLINE

The Challenges

There is little disagreement with the observation that teaching online is decidedly different from teaching in a face-to-face environment. This section will explore first some of the more general environmental differences, then proceed to a discussion of the impact of these differences on the teaching strategies discussed above and summarized in Table 1.

Curtailed Spontaneity and Intimacy. Much of the spontaneity and intimacy both instructors and students enjoy in the classroom is either lost or severely curtailed in an online setting. Since one of the major attractions of the online environment is the freedom from constraints of both time and place, and the students comprising an online course offering might live across several time zones, the attractiveness of real-time (synchronous) interaction is often muted. Feelings of isolation from instructional staff, administration, and other students are not uncommon (Lake, 1999).

Students of Diverse Ages and Characteristics. Online students often present a wide range in age and ability level. These abilities are impacted by the student's previous experiences, both with the technology supporting the online environment and with the college environment. Many of the students enrolled in online classes are non-traditional students and working adults. As such, they bring identifiable strengths and weaknesses to the learning task. Online students in general are considered self-motivated and independent learners. Richardson (1994) found them to have superior time management skills. Kubala (1998) found online students to be daring and confrontational regarding their expression of ideas.

Need to Learn New Skills. At the same time, there are often students in an online classroom that are quite new to the technology by which the learning experience is conveyed. While virtually every student is familiar with the face-to-face classroom setting, the same cannot be said for the online environmental staples such as threaded discussion boards, e-mail, file transfer protocol and media-enhanced Web pages. The maturity and experience of the typical online student described above often is counterbalanced by the multiple responsibilities imposed by family and employer. Without the support and structure provided by the periodic, recognized events found in regularly scheduled class meetings, it is very easy for a student to lose focus on the course. It is not uncommon for an online student to confuse anytime, anyplace flexibility with any-pace license, with the unfortunate result of procrastinating him- or herself to failure.

When teaching technology-intensive courses online, many of the pedagogical tools identified in Table 1 are quite difficult to implement. Of all the pedagogical approaches outlined in Table 1, textbooks are the least negatively impacted by the course delivery mechanism and do, in fact, sometimes offer value-added features through publishers' Web sites. Constructivist-based learning activities have also been effectively incorporated in online courses. The tools and processes for incorporating lectures, guided laboratories, modeling, and collaborative projects are less well understood.

MEETING THE CHALLENGES

This section of the paper will present case studies that explore the processes, tools, and implementations the authors have used to meet both the general challenges of teaching in an online environment and the obstacles specific to teaching technology intensive courses online.

Various tools will be discussed, but the emphasis of the discussion will be on the manner in which the tool can be used to promote learning.

Addressing the General Challenges

Planning. Teaching online presents not only challenges but also extraordinary organizational requirements for the instructor. Organizational structure can be provided through many different avenues. Some of the more common routes taken are use of weekly course modules, a course calendar, a weekly schedule, course outlines, or a detailed syllabus. Without the traditional weekly course meetings, it is easy for a student to "forget" he or she is enrolled in a class. Online classes typically have high drop out rates and one reason is the lack of discipline by the students. Of course, instructors at a distance cannot force discipline upon the students, but constant reminders and schedules do help.

To a very great extent, the balance of work is quite different in an online learning environment. In the traditional classroom setting, much of a teacher's impact on the learning of students occurs during the course of the academic term in general and within the time frame of the class session in specific. In an online environment featuring anytime/anyplace learning opportunities, a significant percentage of the teacher's work must be finalized well before the start of the academic term. In the experiences of these authors, a highly detailed syllabus is essential; it is vital to put most of the course structure in one place.

Setting the Tone. Having something familiar as the student starts a new class diminishes the anxiety of a constantly changing environment. Previous knowledge can more effectively be transferred and reused, allowing cognitive resources to be allocated to learning the new content material, rather than navigating new terrain with different and unfamiliar systems for each course.

Meeting the Needs. To address these issues, the authors have used a detailed syllabus with standard syllabus components. In addition, posting or mailing a "welcome to class" message to students on or just before the first day of the term works well. This "welcome" serves as a reminder that class is now "in session", confirms registration, and explains the appropriate and expected behaviors for the course. Threaded discussion forums have likewise proved quite successful in creating the desired tone. Some of the thread topics that have proven especially helpful are: a student-helping-student thread in which class participants are encouraged to solicit and offer help in resolving technical challenges encountered while doing assignments, and an introduction to the class thread in which students are encouraged to post brief autobiographies augmented with pictures. Pictures and creating a social space are important to create a learning community.

Building Communication. Provision must be made for each of the dimensions of communication within an educational setting. All three aspects of cardinality—one-to-one, one-to-many, and many-to-many—must be available. Likewise, all three directions for communication—teacher-to-student(s), student-to-teacher, and student(s)-to-student(s)—must be accommodated. Finally, a decision regarding communication timing—synchronous, asynchronous, or both—must be made.

The authors have found four guidelines for effective management in promoting communication within the online class.

1. Due to the nature of many online offerings that include students from multiple time zones and varied work schedules, asynchronous is, whenever possible, preferable to synchronous.

2. Student perceptions and expectations regarding prompt response to e-mail and forum postings differ greatly from those of their teachers; instructors need to establish and follow reasonable response time expectations.

3. Highly structured, graded forums in which references are required for all postings provide an excellent simulation of a classroom discussion.

4. Loosely structured, student led, ungraded forums promote a sense of being a part of a learning community.

Evaluation and Feedback. Central to evaluation is selecting the deliverables required of the students. In a traditional classroom setting, tests and lab exercises are perhaps the most commonly used instruments for measuring content level learning. The nature of an online learning environment makes each of these tools somewhat problematic since it is difficult to ensure security and integrity when tests or lab exercises are administered online. The evaluation of learning within the process and premise domains has classically been accomplished with assignments such as research papers, problem-solving practical assignments, and group discussions or debates. This type of assignment, fortunately, is equally applicable to an online learning environment.

The authors have found that the timing and nature of assignment feedback is critical. Since there are no regular weekly meetings, both students and instructors do not have the normal "clock" to measure the passage of time through the course. Since an online environment lacks this natural unit of time, it is vital to clearly communicate to students when they can expect feedback on their assignments, and to honor those dates.

Since oral amplifications are not readily available in an online environment, the need for comprehensive, well articulated written feedback is critical. The use of grading rubrics, summarized feedback of strengths and weaknesses observed throughout the assignment set, and examples of exemplary work have proven effective techniques in enhancing feedback.

Addressing the Challenges Specific to Teaching Technology Online

Lecturing with MIMIO **(2002).** Compiler design is one of the most technically challenging areas in computer science. Topics such as bottom-up parsing, code optimization, and data-flow analysis can be very difficult for students to understand. After teaching a graduate-level compiler design course on-campus and online for several semesters it was obvious that the lack of face-to-face instruction made it more difficult for online students to comprehend the material.

The on-campus and online courses were delivered in a similar manner, using the same textbook, PowerPoint slides, homework assignments, and examinations. Both courses also used an asynchronous bulletin board system to facilitate student-to-student interaction and student-to-teacher interaction. The main difference between the courses was the classroom lecture component of the on-campus course. Due to the highly complex nature of this subject area, short (15-30 minute) well-defined lectures were presented on-campus using a whiteboard. Following each lecture a 30 minute discussion period was used to reinforce the concepts covered in the lecture.

The online course did not have a lecture component. Instead, students were asked to read the text and study the

PowerPoint slides and use the asynchronous bulletin board for discussion. It soon became apparent that the discussions in the bulletin board system were very different in content from their on-campus counterparts. The online students were asking fundamental questions and looking for assistance to clear up confusing topics, while the on-campus students were applying the fundamental concepts to current research problems in the field.

In an attempt to simulate the whiteboard lecture component of an on-campus course in an online course several goals were identified:

> *A classroom lecture must be simulated as closely as possible. This includes synchronized capture of voice and whiteboard activity. Seeing the professor is of little value and therefore not necessary to simulate.*
>
> *In some cases, on-campus students come to the professor's office during office hours and the professor can explain a certain topic. For example, a student might meet with a professor to discuss "shift-reduce conflicts" in grammars. In this setting, the professor would pick up a marker, go to the whiteboard, and 15 minutes later the student should have a much better understanding of the topic. In order for this to be practical, the creation of lectures must be simple.*
>
> *The professor must be able to quickly and efficiently create a lecture or office-hour discussion. Given the course-load of many online faculty, this goal is critical. Most faculty members do not have the luxury of*

> *spending many hours in a studio and many more hours in post-production, as is the case with many video delivery modes.*
>
> *Finally, the tool used to create lectures must be easy to use and install and allow streaming of captured content.*

MIMIO is a whiteboard capture tool that captures both whiteboard activity and voice and allows asynchronous streamed playback using RealPlayer. A MIMIO presentation of a classroom lecture looks to an online student exactly as it looked when the lecture was given in a live classroom.

In order to simulate "office-hour" type discussions, the professor can monitor e-mail and bulletin board discussions for topics that are confusing or difficult and can create lectures with a minimum of effort. Since there is a one-to-one relationship between time spent creating a MIMIO lecture and the lecture itself, there is very little time wasted creating the lecture. One of the problems with using PowerPoint, HTML, and word processors to deliver technical and mathematical content is the large amount of time involved creating diagrams, editing equations and creating animations that help the student understand the material. With MIMIO the equations can be written on the whiteboard, marked-up using color annotations, erased and animated by drawing on the whiteboard. The amount of time saved is substantial.

Since MIMIO captures whiteboard activity using vector-based graphics, presentations are very small and streaming is efficient. A typical 15-minute MIMIO presentation is approximately 2 MB in size, which can be easily streamed over a 56 kbps connection.

Results of Using MIMIO. Based on student feedback, the addition of MIMIO lectures to online courses has been very positive to the learning experience. Students reported that the MIMIO lectures made a tremendous difference for comprehension of the material presented. Less confusion was apparent in the online bulletin board and the discussions became centered on research issues and not fundamental concepts. Interestingly, many students requested certain topics be expanded using MIMIO lectures. In addition, monitoring e-mail and bulletin board activity for potential confusion and addressing these issues with MIMIO lectures led to more fruitful discussions.

For the professor, MIMIO lectures are simple, time saving, effective teaching tools that are invaluable for delivering technical content to online students in an efficient, asynchronous manner.

Collaborative Projects With Threaded Discussion Forums. The value of collaboration as a tool to promote learning is becoming increasingly more evident. Students engaged in collaborative efforts typically retain the information being learned longer by becoming more actively engaged in the learning activity. There is evidence that collaborative activities foster higher-order thinking skills such as analytical reasoning, synthesis of multiple information streams into a whole that is indeed greater than the sum of its parts, and evaluation. Students are introduced to an environment that better prepares them to meet the challenges inherent in succeeding in the workforce. Collaboration is a vital element of the student-centered, constructivist environment widely accepted as an optimal learning paradigm.

Collaborative learning is not easy to foster in a classroom setting; it is exponentially more difficult to establish in an online environment, especially one that is essentially asynchronous. The non-verbal cues that comprise a large part of everyday communication are largely lost through even the richest online environment. Although asynchronous online environments certainly lack the intimacy and immediacy inherent in face-to-face settings and simulated to an extent by synchronous applications, meaningful collaborative assignments are still possible. Using a readily available asynchronous communication tool—the threaded discussion forum—in a systems approach can foster collaborative learning. Such an approach was effectively used in graduate-level courses in multimedia systems. The systems approach developed to foster collaborative learning activities in an asynchronous environment entailed five steps.

Developing Learning Outcomes. The planning process for any course must start with identifying learning outcomes. In order for collaborative learning activities to be meaningful, they must be associated with one or more appropriate learning outcomes. Examples of learning outcomes necessitating collaborative activities for the multimedia systems course include: 1) collaboratively develop a project schedule, requirements document, navigation map, and storyboards to document a well-integrated, media-enhanced product; and 2) collectively produce the media-enhanced product.

Matching Assignments to Learning Outcomes. Again, as with any course, assignments must be designed to promote attainment of learning outcomes. For the multimedia systems course, five assignment deliverables were indicated: a media enhanced product, and four associated planning documents—project schedule, requirements document, navigation map, and storyboards.

Determining Team Composition. For collaborative assignments, it is important to identify the appropriate team composition, including the number of participants, the appropriate roles, and both the role-specific and shared responsibilities. For the multimedia systems course, four roles were indicated for the collaborative assignment: project manager, author, designer, and subject matter expert.

As an example of assignment of responsibilities, the project manager's role entailed the following:

1. Overall responsibility for the quality and timeliness of product development
2. Management responsibility for the development lifecycle, setting a timeline and enforcing due-dates
3. Coordination responsibility for the interaction among group members
4. Coordination responsibility for the efforts of the team, to develop, publish, and maintain the project schedule
5. Responsibility for posting the preliminary version of the project schedule in the appropriate thread of the team's discussion forum area by the due date listed in the course schedule section of the syllabus
6. Responsible for posting up-dated versions of the project schedule in the appropriate thread of the team's discussion forum area as necessary
7. Responsible for submitting the final version of the project schedule, updated to reflect the actual product development process

Establishing Communication Pathways. The nature of the communication pathways is, of course, directly related to the assignment structure. Since the collaborative project entailed five deliverables and six discussion threads—one per deliverable, plus a general communication thread –were indicated for each team. Although students were not prohibited from using synchronous communications tools (chat sessions, conference calls, etc.) or other asynchronous instruments (e-mail), they were strongly encouraged, through the evaluation criteria discussed below, to focus their communication in the discussion threads established for each team.

Evaluation. One of the biggest concerns regarding collaborative activities for both students and teachers is evaluation. Even in face-to-face settings it is difficult to identify and appropriately address a "freeloader" in a group. In an unconstrained setting such as an asynchronous learning environment, in which students are separated by both time and place and the instructor has only indirect contact, fair and accurate evaluation is indeed troublesome. To address this concern, the evaluation of the collaborative assignment included both group and individual factors. The criteria used for the multimedia systems course are detailed in Table 2.

TABLE 2
Evaluation Criteria for Multimedia Systems Team Assignment

1) Fifty-five percent of the assignment grade was based on the work of the team as a whole. This assignment was based on the quality of the final product produced, including: quality of media elements; effective integration of media elements; effective interactivity; synthesis of media elements to improve communication.
2) The remaining 45% of the assignment grade was evenly divided among three elements of individual work as a member of the team.
    a) Performance in assigned role as shown by the item of documentation for which she or he was responsible.
    b) The Collaboration Reflection in which the student analyzed the contributions each member of the team made to the team effort and assessed the overall value of the group experience.
    c) The instructor's assessment of the student's participation on the team, as measured by her or his contributions to the team discussed forum threads.

Special Challenges with Special Solutions—Asynchronous Guided Laboratory Exercises

Technical courses typically combine a lecture component in which terms and concepts are presented and discussed with an instructor-led laboratory component in which the students, through guided application, process those concepts. In an undergraduate course in Visual Basic, for example, instructors present the terms that comprise the language's syntax and the concepts of analysis and design in lectures. The lectures are supplemented by instructor-led laboratory sessions to foster the processing aspect of learning through programming exercises in which the student must analyze a problem, develop an effective design, and correctly code a solution.

It is relatively easy to present the material that typically comprised classroom lectures using online tools such as MIMIO, since the communication is predominately one-to-many, instructor-to-student oriented. The laboratory sessions are much more difficult to emulate online. Even when obvious challenges such as hardware and software incompatibilities are controlled through the use of course requirements, the essential challenge of creating the one-to-one, instructor-to-student, student-to-instructor, communication that is central to the laboratory experience is quite difficult to incorporate.

Although synchronous tools ranging from plain text chat rooms to highly interactive video teleconferencing facilities present promise as tools to simulate laboratory experiences, they are far from ideal since many students select online courses specifically for the "anytime" freedom offered. The problem is exacerbated in many schools where students in the same online class may be spread across ten or more time zones. For many students, an asynchronous laboratory experience is the only viable option.

The necessary support and one-to-one, instructor-to-student, student-to-instructor, communication inherent in a laboratory experience can be at least partially provided in an asynchronous online environment by a combination of careful "chunking" of the assignment into small, discrete elements and use of graphically-enhanced feedback for each "chunk". This approach was successfully implemented in an asynchronous, online offering of an undergraduate course in Visual Basic.

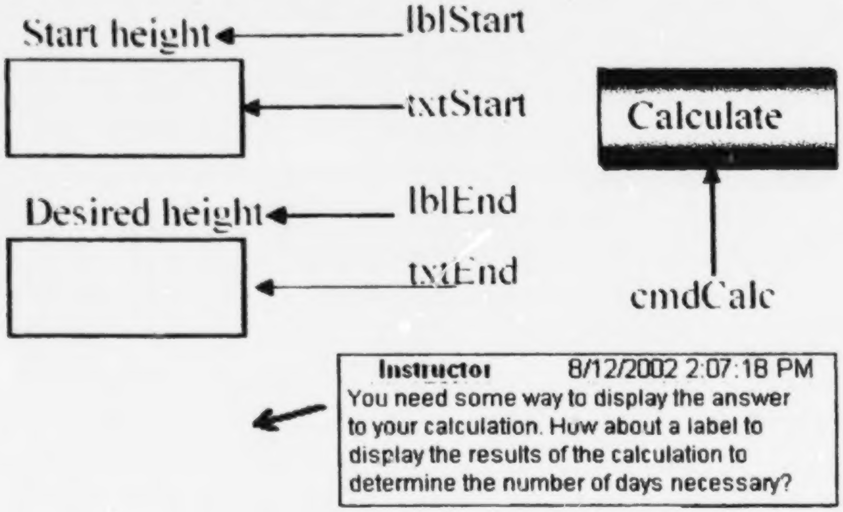
The Visual Basic Lab. The Visual Basic laboratory assignments all started with a problem statement that detailed the rationale for the program the students were to produce. For example, the following is the problem statement used in a laboratory assignment that reinforced the repetition structure:

> *SuperGrow plant food makes plants double their height each day. Write a program that would allow the user to enter the original and desired heights of the plant. The program should then calculate how many days SuperGrow will have to be used.*

The students were responsible for producing six planning documents for the assignment: a task list, a Task-Object-Property-Event (TOPE) chart, a sketch of the user interface, pseudocode, a flowchart, and the actual program code. The documents were to be submitted to the instructor in sequential order as e-mail attachments, and the student was advised to await feedback on a document before proceeding to the next document if s/he were uncertain of the solution.

The instructor converted the student's document to Adobe Acrobat format, and used the drawing and note tools available in the product to identify any problems with the plan. Figure 1 below presents an example of feedback on the sketch of the user interface submissions for the repetition laboratory assignment.

Figure 1
Sketch of the User Interface



Instructor 8/12/2002 2:07:18 PM
You need some way to display the answer to your calculation. How about a label to display the results of the calculation to determine the number of days necessary?

CONCLUSIONS

Teaching technology in an online environment presents challenges. Tools are being developed that allow learning to take place quite effectively in this environment. Better tools are still needed. Continued upgrades in bandwidth and transmission speed are still needed. Better software and hardware compatibility is still a problem. As the technology matures additional requirements to share graphics and other resource intensive materials will be supported.

Palloff and Pratt (1999) summarized the need for this examination of teaching approaches quite well when they said "Successful online distance education is a process of taking our very best practices in the classroom and bringing them into a new arena. In this new arena, however, the practices may not look exactly the same" (p. 6).

Distance education has come a long way since the early correspondence courses, the precursor to today's richer distance education environments. The teacher is often seen as a facilitator and knowledge is easily shared among the participants creating a very open and freely sharing community of learners. Virtual classrooms and other distance education tools are becoming an accepted means of education across the curriculum. Providing education across the miles and across temporal boundaries are allowing groups of people educational opportunities that previously had been inaccessible.

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FACILITATING INTERACTION IN WEB-BASED INSTRUCTION

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INTRODUCTION

The enormous growth of the Internet and the use of Web-based instruction has presented educators with both opportunities and challenges (Boettcher, 1999; Kroder, et al., 1998). One of the more notable challenges stems from concern over the lack of interactivity in cyberspace. Concern has arisen over the lack of interaction in virtual learning environments, as many educators (who are often critics of online education) believe that the interactivity of the traditional classroom is a vital, yet missing, part of Web-based instruction. For example, Roberson and Klotz (2001) have suggested:

> The literature provides evidence that often on-line courses are configured and delivered in a style more often associated with independent study or correspondence work, i.e., students working independently to complete posted assignments at their own pace. While this format may work in some instances, it leaves a "missing link" in the learning curve for students since they lack the opportunity to benefit from the experience of structured dialogue and sense of community that can be created in a traditional on-site classroom environment (p. 4).

In fact, researchers (Boaz et al., 1999; Kearsley, 2000) have asserted that the most successful distance learning students are capable of independent study. However, there is a sizeable cohort of students who enroll in Web-based instruction who are seeking an interactive learning experience. This article purports to add to the discussion that considers synchronous computer-mediated communication as a possible method for providing interaction and community in Web-based instruction.

Interactivity In Distance Education Courses

Three areas of interaction are typically identified as meaningful interaction in online and distance education courses: 1) learner-content interaction; 2) learner-instructor inter-action; and 3) learner-learner interaction (Kirby, 1999; Moore & Kearsley, 1996). The subject of interactivity, specifically learner-learner and learner-instructor, has been the source for much of the recent controversy among distance learning professionals. The interactivity of the traditional classroom is a vital, yet missing, part of Web-based instruction (Cook, 2000; Kirby, 1999; Muirhead, 2001; Seabolt & Arends, 2000). Schmidt (2002) wrote:

> … If an instructor decides to put a course entirely on the Web, understanding the community component and the communication tools becomes imperative. Effectively replacing the traditional classroom interaction is one of the greatest challenges in placing an entire course on the Internet (p. 6).

Computer-based instruction, the initial paradigm for online learning, focused on the interaction between students and computer drills, tutorials or simulations. Computer-mediated communication, the current and prevailing paradigm in distance education contexts, focuses on the interaction between students and the instructors, which is mediated by the computer (Kearsley, 2000).

WEB-BASED INSTRUCTION: THREE CRUCIAL FACTORS

Distance learning generally falls into two categories: synchronous—fixed time; and asynchronous—any time, anyplace (Boaz et al., 1999). Online courses typically incorporate e-mail, threaded discussions, real-time conferencing, or some combination of these elements. Key areas for discussion of the quality of teaching and learning in Web-based instruction include: 1) the affective dimension; 2) aids and barriers to the establishment of a learning community; and 3) synchronous versus asynchronous interaction (Harmon & Jones, 2000).

The Affective Dimension

"The enthusiasm surrounding the Internet's role as a platform for online educational forums has been fueled by wider societal excitement surrounding computer-mediated communication (CMC) and its potential for altering and creating new forms of social relations" (Selwyn, 2000, p. 752). King and Baxter-Magolda (1999) suggested an integrated perspective of the cognitive and affective dimensions of development as related parts of one process. They defined a successful educational experience as one that simultaneously increased cognitive understanding and sense of self, personal maturity, and interpersonal effectiveness.

Riva and Galimberti (2001) built upon Mantovani's (1996) three-level (domain) model, which links social context, life's situations, and the use of computer technology. They proposed a revised model that addressed the mediated communication between instructor and students. Riva and Galimberti (2001) characterized their revised model, for the study and analysis of Internet-based instruction, as one of interpersonal interaction that is structured on three different levels:

> …the context: social content in general; the situation: ordinary situations of everyday life in which the Internet experience occurs; and the interaction: local interaction with the other actors [instructor and students] using a technological artifact (Internet) (p. 4).

Galimberti and Riva (2001) perhaps put it best when they write: "Cyberspace is standing out there waiting for us to study it from a psychosocial perspective"(p. 3).

Establishing a Learning Community in Cyberspace

Electronic conferences are a medium in which community can develop among graduate students as the students work cooperatively to facilitate the joint negotiation of academic meaning (Jeong, 1996; Powers & Mitchell, 1997; Simich-Dudgeon, 1999; Weedman, 1999). Computer-mediated communication can be used to effect collaborative learning in graduate courses taught in an online environment (Stacey, 1999), and it can support the construction of online learning communities (Frankos, 2001), which provide significant social and academic support to graduate students in distance education contexts (Johnson, 1999; Lally & Barrett, 1999).

To promote a learning community, synchronous activity helps more than asynchronous; initial bonding is important; and multiple means of communication that support and encourage social interaction are needed (Distance Education Report, 2000).

Asynchronous vs. Synchronous Communication

> Computer-mediated communication (CMC) refers to the use of networks of computers to facilitate interaction between spatially separated learners; these technologies include electronic mail, computer conferencing, and on-line databases. Computer conferencing and electronic mail support sophisticated synchronous (real-time) or asynchronous (delayed) group communications. (Jonassen, et al., 1995, p. 7).

Bourne, et al. (1997) characterize asynchronous learning networks as being able to provide anywhere/anytime learning. "Synchronous methods are those that require that learners participate in a learning event at a specific time. These methods include on-line chat, listening to a live audio or video broadcast, and telephone, including conference calls" (Bourne et al., 1997, p. 5). Bourne et al. (1997) conceded the following:

> A wide variety of issues remain to be resolved, including how to impart the "closeness" of an intense face-to-face interaction to asynchronous learning networks (ALNs)…Face-to-face interactions permit a professor (leader, facilitator) to rapidly change the direction of the discussion and to directly satisfy the needs of the learners. The group can also rapidly interact and come to agreement. None of these kinds of direct interactions can be quickly accomplished using ALN modalities (p. 7).

Jonassen et al. (1995) asserted, "Conversation is entailed by collaboration. Individuals and groups must negotiate plans for problem solving before implementing those plans." (p. 14). Johnson et al. (1991) discussion of learning, as a social process that involves interpersonal interaction and cooperation, seems to offer prophetic and visionary support for synchronous communication in establishing learning communities in distance learning environments.

SYNCHRONOUS COMPUTER MEDIATED COMMUNICATION

Bagi and Crooks (2001) identified chats as one of ten synchronous instructional features that allows students to meet and interact with one another in a virtual classroom at a specific time while helping to create a social constructivist-learning environment. Synchronous chatting, a same time/different place (Flatley, 1996) form of computer-mediated communication, is gaining attention (Simpson, 1999; Stewart, et al., 1999) in virtual learning environments. Tools such as chat rooms attempt to simulate the human contact generally associated with face-to-face teaching (Charp, 2000).

Synchronous computer-mediated communication has become an increasingly popular way to communicate for a variety of purposes (Darhower, 2000), especially in online learning and distance education contexts. Synchronous Web chats can help to make Web-based distance learning courses more interactive (Cafolla & Knee, 1999; Davidson-Shiverset al., 2000; Sorg and McElhinney, 2000).

Computer-mediated communication, especially computer conferencing via real-time chats, supports constructive learning (Chou, 2001; Jonassen et al., 1995). Osciak & Milheim (2001) also reference Gardner's

Multiple Intelligence Theory, pointing out the appeal of such synchronous text-based interaction to those individuals who enjoy writing (verbal intelligence) and who require the interaction and reflection of the interpersonal and intrapersonal intelligences (Goleman, 1995).

Advantages to using chats include the following:

> *Chats recognize the affective dimension. Cognitive information can be distributed in a learning environment that supports the theories of multiple learning styles and multiple intelligences.*
>
> *Chats aid in establishment of a learning community. Interactive discussions can occur among a diverse group of students that allow sharing of different perspective and ideas.*
>
> *Chats encourage active, cooperative and collaborative learning. Students can participate in small-group learning experiences, with or without the instructor.*

SUMMARY

Effective Web-based and online courses should maintain student interest, motivation, satisfaction and success (Powell, 2001). To achieve these elements, online courses should provide frequent and repeated opportunities for students to act, react, and interact. The design of the course should require that students think critically, demonstrate problem solving skills, cooperate and collaborate, and actively engage in learning.

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Chatting, a form of synchronous computer-mediated communication, enables real-time online interaction between individuals who access, at a given moment, the virtual chat room site (Bento & Bento, 2000). Although chatting over the Internet does not require face-to-face communication (Hatala, et al., 1999), it psuedo-personalizes the Internet, which can sometimes seem cold and robotic, and it is more immediate than e-mail exchanges (Simpson, 1999).

While Herod (2000) pointed out that the physical cues used to convey interpersonal presence in face-to-face learning environments are absent in text-based computer-mediated communication courses, Chan (1997) concluded that electronic chats can: 1) increase student participation; 2) facilitate discussion of class readings; 3) enhance critical thinking; 4) encourage discussion of ideas from different perspectives; and 5) build teamwork and a sense of community.

Critics of the synchronous chat room downplay its use, as it rails in the face of the flexibility of anytime/anyplace learning and asynchronous learning networks. To be sure, there are drawbacks to using synchronous chat forums (e.g., a real-time degree of commitment is required from both faculty and students). While the synchronous chat is not a panacea for resolving the issue of interactivity in Web-based and distance education contexts, it may be one of the more likely candidates to replace the interactivity of the face-to-face classroom (Williams, 1999).

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TRANSFER OF LEARNING:
EVALUATING WORKPLACE
TRANSFER OF TRAINING TECHNIQUES

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INTRODUCTION

This paper defines transfer of learning in the framework of learning in one context (workplace training) and successfully applying it to another context (community college classrooms). A study done in 1989 revealed that employers deliver learning to more people than does the entire U.S. higher-education system (Merriam & Caffarella,1991). These non-educational organizations have played an increasingly larger role in adult education to meet 21st century workplace needs in both the private and public sector. The training techniques they have practiced and evaluated over the past fifteen years can benefit a learner-centered college institution (O'Banion,1997).

Emphasizing adult learning theories, Knowles (1980) is used in this paper to support workplace training techniques. Learning environments defined by Knowles (1980) are reviewed as an important factor for the transfer of learning. Since transfer of learning also increases when mentoring and coaching is included as a follow-up or the learner continues self-directed study or job application of skills or knowledge, these factors are also examined.

WHAT IS TRANSFER OF LEARNING?

Transfer takes place when existing knowledge, abilities and skills assist us in the performance of new tasks or affect the next step in the learning process. Often, what is learned in the classroom is not transferred until the student successfully applies or practices the learning in a new or work situation. In summary, transfer of learning occurs when the learning in one context or with one set of materials impacts the performance in another context or with other related materials (Bransford, et al., 2002). Consequently, the end goals of education or training are not achieved unless transfer occurs.

The concepts of transfer have been practiced to a large extent in business and industry. Referred to as "transfer of training," companies have found it is critical for employees and managers to learn and retain new skills rapidly to stay competitive. Much of the research regarding transfer was conducted in educational settings, but flexible, non-traditional, and innovative training departments have had the greatest opportunity to test the theories.

Research Findings. Factors that theorists have discovered regarding transfer of learning include: meaningful learning promotes better transfer than rote learning; the more thoroughly something is learned, the more likely it is to be transferred to a new situation; the more similar two situations are, the more likely it is that what is learned in one situation will be applied to the other situation; principles are more easily transferred than knowledge; and the probability of transfer decreases as the time interval between the original task and the transfer task increases (Bronner, 2001).

THEORIES AND PRACTICES IN ADULT LEARNING

Faculty and teachers are familiar with the theory of pedagogy—the art and science of helping children learn. Workplace trainers prefer the andragogy theory—the study of how adults prefer to learn. In community colleges, the average age of students is 18 to 24 years old. Companies consider this age group as adults, even through they may have recently left the K-12 schools.

Characteristics of Adult Learners

Knowles (1980) theory of adult learning is based on five assumptions or characteristics of adult learners:

1. As a person matures, his or her self-concept moves from that of a dependent personality toward one of a self-directing human being
2. An adult accumulates a growing reservoir of experience, which is a rich source for learning
3. The readiness of an adult to learn is closely related to the development tasks of his or her social role
4. There is a change in time perspective as people mature—from future application of knowledge to immediacy of application—thus an adult is more problem-centered than subject-centered in learning
5. Adults are motivated to learn by internal factors rather than external ones.

The value of understanding this theory impacts the degree in which the facilitator can enhance the adult learning process and improve the transfer of learning.

Learning Environments

Organizational factors—people, structure, and culture—can also impact the transfer of learning. As Knowles (1980) has stated:

> The quality of learning that takes place in an organization is affected by the kind of organization it is. This is to say that an organization is not simply an instrumentality for providing organized learning activities to adults; it also provides an environment that either facilitates or inhibits learning (p. 66).

Learning environments are usually addressed in terms of a place that is welcoming and supporting, a facility designed for adult learning, and a positive emotional or psychological climate. According to Merriam and Caffarella (1991), few researchers have seriously addressed the issue of positive environments for learning.

While many classroom environments in community colleges remain traditional with small wooden desks and black boards, business and industry has designed training centers conducive to adult learning. Features include comfortable chairs, tables arranged in a semi-circle for learner interaction or in round tables for team discussions, computer projectors with computer lap tops for visual presentations, multiple flip charts for learners to brainstorm and list ideas, and other multi-media features.

Coaching and Mentoring

There is considerable evidence that a critical factor influencing transfer of learning is the extent to which one is able to practice and receive constructive feedback. One-on-one coaching or mentoring provides this opportunity. Coaching provides a safe environment in which practice and feedback can take place. There has been a rapid growth in the use of one-on-one executive coaching. Among the organizations adopting this practice are: American Express, the American Management Association, AT&T, Citibank, Colgate, Levi Strauss, Northern Telcom, NYNEX, and Procter & Gamble (Olivero & Bane, 1997).

A pilot program of executive coaching at a public sector organization yielded productivity increases almost four times the level achieved by training alone (Olivero & Bane, 1997). One reason for the dramatic success was the use of goal setting. When the coach and the person being coached worked together to define concrete actions, it lead to higher transfer levels.

Problem-Based Learning

One of the most prominent classroom techniques used in corporations to create a learner-centered environment is problem-based learning. Problem-based learning, an instructional model based on constructivism, is the concept that learners construct their own understanding by relating concrete experience to existing knowledge where processes of collaboration and reflection are involved (Perrenet, 2000; Reese, 2001; Savoie & Hughes, 1994). Posner & Rudnitsky (2001) give scientific support for problem-based learning. They note that "a crucial determinant of learning is students' thinking or cognitive processing, and this processing is directly influenced by the kind of tasks in which students actually engage" (p.153).

In problem-based learning, students are presented with a loosely structured problem—one that has no obvious solution and for which problem-solvers cannot be certain they have the right answer. The problem must be content relevant and represent a real situation faced by an individual, group, company, or community. Problem-based learning is an important strategy choice because "in a society where change is constant and teamwork is a way of life at work, the lessons learned through involvement in problem-based learning are essential for students' career development (Office of Educational Research and Improvement, 1996)."

TRANSFER IN THE WORKPLACE

Transfer strategies in the workplace go beyond the training class. Supervisors and employees must actively participate for transfer of learning to take place. Supervisors can support learners by ensuring their work assignments are covered while employees are learning. Similarly, reward and recognition of the value of learning, and review and debrief with the employee concerning what was learned can facilitate transfer. Participation in a transfer action plan to immediately apply the learning to the job can also help (Bransford, 2002).

Transfer increases if the employee can participate in the planning process for professional development and is able to evaluate how the plan aligns with professional, department, and organizational goals. And of course, if the employee continues self-directed learning with additional educational materials available to him or her, transfer is facilitated.

Review Following Learning. Research shows that there is a sharp drop-off in memory and recall capabilities following initial training, especially if there is not an immediate and regular application of the knowledge or when too much time passes before the learner reviews the course materials.

Learners should periodically review their course materials following a training program. If a supervisor does not have time to provide feedback and input, a mentor or coach should be assigned who has similar skills and background to assist the learner with the application of the newly acquired skills or knowledge. All of these principles can easily be applied in a community college classroom.

SUMMARY

All new learning is based on previous learning. When relevancy and experience (from previous learning) are brought to the learning environment, transfer occurs (Bronner, 2001). Findings also indicate transfer is adequately reflected by learners' abilities to solve a set of transfer problems right after they have engaged in an initial learning task.

Transfer also increases when learners can apply original learning in one context to multiple contexts. For example, a learner may learn Microsoft Excel spreadsheet design in the classroom, yet transfer does not occur until the learner creates graphs and charts in the context of his or her employment and designs a budget in the context of personal home expenses.

As workplace trainers have discovered how to make learning relevant and transferable to the workplace, college faculty can incorporate the same concepts so that students not only pass the test, but are able to apply the learning to their new careers.

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ENCOURAGING INNOVATION:
PLANNING AND EVALUATING
TECHNOLOGY PROGRAMS

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INTRODUCTION

Despite the millions of dollars and staff hours devoted to introducing new technologies into post-secondary classrooms, the preponderant method of college instruction remains the lecture. Most faculty hold tight to the model of teaching which requires them to stand before the masses, pronounce their wisdom, and test whether their students have captured the meaning of their words.

Lectures are as efficient as other instructional methods when the goal is simple transmission of knowledge. However, higher education is about much more than acquiring knowledge for the duration of a course. Lectures are less effective when measuring for students' ability to retain knowledge, transfer that knowledge to new situations, solve problems, change their attitudes, or develop a desire for further learning. (McKeachie, 1999).

How do we best encourage faculty to experiment with new instructional methods and models? And how do we know that our efforts at encouraging innovation actually work? This paper attempts to shed light on these two questions and presents as a case study a program designed to encourage faculty to incorporate technology into their eaching at Lincoln University, in Canterbury, New Zealand.

Encouraging Innovation

Faculty members tend to teach as they have been taught. Until they have experienced alternative methods and come to accept that different people learn differently, they really have no instructional decision to make.

To help faculty adopt new instructional strategies first requires raising their awareness of how students learn and modeling alternate instructional strategies. Supporting their moves to teach differently involves helping them develop skill using various methods and assisting them in knowing when to apply which method to optimize student learning (Joyce & Showers, 1988). The process is further complicated when staff are expected to use technologies with which they are unfamiliar.

Attempts at encouraging innovation should follow these four principles:

1. Efforts at encouraging change must be designed in context with the institutional framework and the disciplinary and pedagogical interests of the faculty.

2. Faculty learn new strategies just as their students learn new concepts and skills. They will learn in different ways, develop idiosyncratic understandings and prefer different types and levels of learning assistance.

3. To be most effective in implementing change requires that a support team "be there" when it happens. (Joyce & Showers, 1988). Demonstrations, workshops, conferences, mentoring, journal articles, feedback and simulations are much more effective when they are accompanied by a professional support team

which is alongside the faculty as they attempt new instructional strategies.

4. Educational change is a process not an event. For any innovation to become de rigueur takes time. Faculty must have time to try it out, become comfortable with it, tweak it to fit themselves, and experiment with alternate applications.

The Concerns-Based Adoption Model (CBAM). This model is often applied to the problem of determining when and why faculty become interested in adopting technology in their teaching. This model, developed by Hall and Hord in 1987, is based upon the idea that people considering or experiencing change move through a seven-stage process that evolves from a total lack of awareness through questioning the personal impact of making the change to a consideration of the impact of the change on others and possibilities for further refinement of the innovation. It typically takes teachers three years to move through the entire process (National Academy of Sciences, 1998).

The concerns model has major implications for professional development. The types of professional development experiences appropriate for faculty just learning about the existence of a new technology is quite different from those appropriate for those who are eager to give it a try.

Table 1 delineates appropriate staff development opportunities for each stage of concern. It is important to note that the experiences list is cumulative. For example, faculty in the Collaboration stage of concern may still be interested in workshops, incentives, and classroom research opportunities.

Table 1
Matching Faculty Stage of Concern with Staff Development Experiences

Stage of Concern	Statements Indicative of Stage	Appropriate Development Activation
6. Refocusing	How can I refine my work to make it better? Where else could I apply this?	Collaboration with instructional designers, assistance with program evaluation
5. Collaboration	Who else is using this? How can I share my experience with others?	On-campus or electronic discussion groups, conference attendance and presentations.
4. Consequence	What difference is making for my students?	Help designing classroom action research projects
3. Management	How am I going to find the time to do this? Where can I get the equipment? Are there people who can help me?	Provision of incentives such as released time, equipment grants, student assistants, summer pay for media development or in-depth training
2. Personal	Can I do this? How will this affect me in terms of my quest for tenure?	Hands-on workshops, how-to documents, assurance of institutional support for the activity
1. Informational	I'd like to know more about this	Exhibits, demonstrations, newsletters
0. Awareness	I know nothing of this. This doesn't interest me.	Advertisements promoting events and oportunities.

Assessing Efforts at Encouraging Innovation

To determine how successfully one's efforts are working requires stepping back long enough to look at the project objectively. This is best done through a formal plan of evaluation. The evaluation can look at the program in terms of participant perceptions *(Did they think it was useful?)*, its effectiveness *(Did it accomplish what it set out to do?)*, its efficiency *(Did its cost in terms of dollars, time, and human resources justify its benefits?)*, and/or its impact *(Is there evidence of sustained change? What are its long-term benefits or consequences?)*.

Ideally, the evaluation plan is designed while the program itself is in the planning stages. Often, it is not and project managers are faced with the questions outlined above.

McNamara (1998) described three major types of program evaluation: goals-based evaluations, process-based evaluations, and outcomes-based evaluations. Goals-based evaluations are concerned with whether or not the program's goals and objectives were met. They may also consider whether or not the goals should be modified, whether resources available are adequate for accomplishing the goals, and if there should be changes made in the established timelines and program priorities.

Process-based evaluations focus on the means and methods by which a program operates. They may be looking for inefficiencies or systems that work smoothly and could be replicated elsewhere. Process-based evaluations may consider how faculty are trained to use the technology, how faculty interact with technology support personnel, and any suggestions from participants regarding how the program could be improved.

Outcomes-based evaluations are focused on the impact of the program. Is the educational community benefiting? Is there evidence of changed instruction, improved student learning? Is the faculty eager to adopt additional technology-based methods?

There are many books and online resources available on methods for gathering and analyzing evidence as part of the program evaluation process. Two excellence online resources are the Basic Guide to Program Evaluation (McNamara, 1998) and Taking Stock (Bond et al., 1997).

CASE STUDY: LEARN@LINCOLN

Lincoln University is the smallest university (3,800 FTE students) in New Zealand. It offers interdisciplinary undergraduate and postgraduate programs in business, agriculture, environmental science, and human and leisure studies.

The Initial Phase. In the late 1990's the university began a concentrated effort at encouraging faculty to use Internet-based technologies in their teaching. The effort began with staff within the university's staff development center surveying faculty members. The survey asked about their interest in adopting IT-based methods and the resources they would need in order to incorporate more technology-based instructional methods in their classrooms. Their responses addressed three critical areas of need: easier access to equipment and software in their classrooms, instructional design assistance, and technical support for developing new curriculum resources.

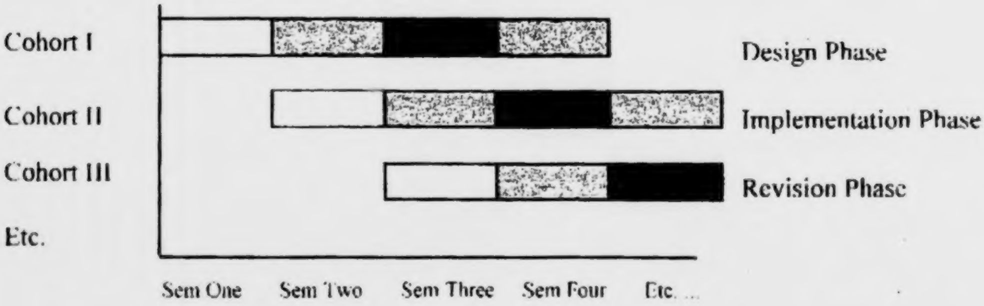
Through leveraging this data, the professional development staff successfully lobbied for increased funding of classroom technology. They achieved additional classrooms with permanently installed multimedia teaching stations, additional mobile carts equipped with laptop computers and data projectors, and upgrade of the wiring in all classrooms for Internet connection capability.

Phase Two. Turning to support with instructional design and media development, center staff then devoted all their financial and most of their personnel resources to the creation and promotion of a single initiative: "Project Learn." The project, later renamed "Learn@Lincoln," was based upon two lines of research: how students learn and how teachers adopt innovative teaching methods.

Project personnel recognized that developing a deeper understanding of content requires more than passively absorbing a body of facts and regurgitating it in an examination. A key premise to Learn@Lincoln was that the instructional resources developed would engage students in exercises that could be described as active learning experiences, using Bonwell and Eison's (1991) definition of active learning as "instructional activities involving students in doing things and thinking about what they are doing."

As demonstrated in Figure 1, the project entailed a continuous cycle of resource development, implementation, revision, and assessment. In the design phase, each faculty member met with an instructional designer and the project manager to determine how the interactive capabilities of the Web might be exploited to meet the particularly challenging aspects of their subject. Subsequent sessions involved the academic staff delivering content material to the Learn@Lincoln team, media developers demonstrating work in progress, field-testing materials, and discussing further refinement of resources.

Figure 1
Learn@Lincoln Development and Implementation Cycle



Phase Three. Just prior to the beginning of classes (the Implementation Phase), participating academics and their support staff were invited to attend a workshop that introduced them to FrontPage, the software used in developing and maintaining Web resources. In the instance in which students would be required to do Web authoring, they, too, received similar specialist training in the early weeks of the semester.

Consultation sessions were held to discuss how the Learn@Lincoln materials would be incorporated into planned instructional and assessment strategies. Some faculty received additional individual support in maintaining their web pages throughout the semester of implementation. Others preferred to maintain their pages themselves, seeking assistance only as needed.

Given that most Lincoln University subjects are offered only one semester per year, the semester following implementation offered ample opportunity for revision of the materials or instructional strategies to be used during subsequent usage.

Evaluating Learn@Lincoln

As the evaluation was seen as a critical element for success, it was built into the original project plan. Ongoing formative assessment took place in the form of bi-weekly meetings of the instructional design and media development staff.

At the end of each semester, participating academics were asked to give feedback on their satisfaction with the support the team gave them and the quality and useful of the teaching resources created. Students were asked to give feedback on the resources in terms of how they contributed to their learning and their ease of use. Finally, meetings were held with the computing services department to review the impact the project was having on computing resources and where additional support was needed.

Results

Faculty. In terms of goals-based evaluation, Learn@Lincoln met its goals of increasing the number of faculty who were incorporating Internet-based technologies in their teaching and involving their students in higher-order thinking and active learning experiences.

Within three years, the Learn@Lincoln team had created and was continuing to support 126 courses, reaching virtually the entire undergraduate student population and many taking postgraduate classes. Approximately one-third of the Website included original programmed material—online tutorials, interactive self-check quizzes, etc.

Many of the courses used the one-way broadcast communication capabilities offered through their Website's bulletin board; a few used the discussion features. However, most instructors were using their Websites for simple distribution of inert information such as syllabi, written lecture notes, study questions, and previous exams.

Despite the project staff's high aspirations to create instructional resources that would engage students in an active learning experience, the fact that most of the Websites were little more than electronic filing cabinets was not seen as a failure. Rather, it was seen as an example of taking staff where they are, getting them comfortable with a new way of doing things, and gradually introducing them to the more sophisticated possibilities the technology offers.

The Model. In terms of the Concerns-Based Model, the team was taking these faculty members from the Awareness Stage up through the Management Stage of concern. Those lecturers who had started at a higher place in the model were moving through the Consequence, Collaboration, and Refocusing stages.

Focus Group. Seven of the original twelve participating academic staff members attended a focus group session held in August, 1998. All recognized the potential of using the Web for teaching. Some noted that students learned in different ways and the Web resources provided another learning option—one that might be most beneficial to visual learners. They were happy with the quality of the product produced for their subjects and felt that the team approach was a strength of the program. All stated that they intended to continue using the Learn@Lincoln materials in future semesters.

One academic included an assignment that required students to create their own Web pages. His students soon mastered the software and enjoyed creating their own Web pages. Many students have since told him that they are now using their Web authoring skills in other subjects. He felt that students gained a more thorough understanding of the content as they created their Web pages than they did with the instructional methods he had used previously. He also believed that the assignment was not just giving something to the students to just do for themselves, but rather creating something they could contribute to the lecturer and their peers.

Students. Usage data showed that students accessed the resources from on-campus and off-campus locations and at all hours of the day and night. For example, better than 2000 students (representing virtually all of the undergraduate population) accessed their.Learn@Lincoln Web resources a median number of 119 times during Semester One 2000. The subject with the highest average number of hits (660 hits per students over the 12-week semester) required students to make tutorial bookings, answer on-line questions, frequently check the notices pages, discuss relevant local legislation, access documentation for case studies, and refer to off-campus Web sites for needed supplementary information.

Overall, the students agreed that the resources created for their subject enhanced their learning and "were a worthwhile use of their time". Students reported that the most useful Web resources were, in descending order: class notices, lecture notes, practice questions and tutorials, samples of previous examinations, ready access to the subject outline and e-mail contact with tutors. It is important to note that those students who could be described as "computer literate" responded more positively to the on-line materials.

When asked how their subject's Website could be improved, the most frequent suggestions called for the inclusion of additional resources, such as:

- Results from tests and assignments as they are marked
- Worked answers to the tests and assignments
- More sample tests and practice questions or quizzes
- Additional topics
- Links to more related sites and current events articles

Additional Benefits. Other benefits found from using the Learn@Lincoln material were:

- Time savings—First, queries from students were quickly answered through e-mails to the tutors and lecturers, relieving class time from such matters and saving students' (and ultimately lecturers') personal time. Second, rather than spend extra time explaining concepts the lecturer could direct the students towards the Web resources where the material was clearly explained in a user friendly manner.

- Relief from administrative hassles—The notices feature was especially useful for getting information out to students, saving class time from such matters and innumerable office visits or e-mail messages.
- 24-hr access to learning resources—Learning resources were available on-line for students to access at any time of the day. Server log files showed that students accessed the Websites from on and off-campus during day and evening hours.

Process. In terms of process, perhaps the most effective strategy put in place was targeting specific groups of faculty: those faculty teaching compulsory undergraduate courses. During the first year, a cohort of faculty teaching first-year classes was created. In the second year, it was those teaching second-year classes, etc. This had two effects. First, by working with relatively small numbers of faculty the project team was able to reach a relatively large group of students. (In the first semester of implementation, project staff were working with only 12 lecturers but reaching approximately 800 freshman students.)

Second, as these students entered their second semester and second year of studying they were pressing their professors for Web-based materials. This, alone, raised these professors' stage of concern from awareness to informational or personal.

In terms of institutional impact, Learn@Lincoln quickly became highly visible across the campus community. It was the topic of university-wide staff meetings, cited in teaching awards, and referenced in corporate planning and reporting documents. External visibility came about through publication of several articles in the regional press; presentation at regional, national, and international professional conferences; and invited seminars at several New Zealand tertiary education institutions.

Initially the faculty development center had to do a lot of "selling" in divisional meetings to encourage lecturers to participate in the project. Within three semesters it was no longer necessary to do this direct solicitation. Between the student requests for course materials on the Web and other lecturers convincing their colleagues that Learn@Lincoln was do-able and useful to both faculty and students, lecturers began actively seeking to be included in the project. Thus in the first year the staff development personnel were virtually begging academics to learn about the Web-based teaching project, while after three semesters faculty were begging to be included in the project.

Resources and Funding. It must be recognized that Learn@Lincoln also resulted in additional stress being placed on resources the university provided undergraduate students. As a result of the feedback received from students regarding ease of access to computers and ease of use of the Learn@Lincoln materials; the university extended the hours and placed additional computers in some of the open access labs. It also provided for the piloting of print-only workstations, developed an online tutorial for using the Web, and, for the first time, offered two hour introductory computing workshops for undergraduate students.

Learn@Lincoln was originally a bottom-up endeavor, with funding coming from staff development allocations and most personnel adding the Web development tasks to their existing responsibilities. After three-years of successful implementation, executive management finally approved funds which provided institutionalization of the initiative. Most of the funds allocated were for offering continuing contracts to the 1.5 FTE staff who had been working on the project on a temporary contract basis.

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DIFFERENCES IN PREDICTORS OF ONLINE AND CLASSROOM PERFORMANCE

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INTRODUCTION

There has been a plethora of research comparing the academic performance of students in online and traditional classrooms. The general finding has been that there is no statistically significant difference in the grades of students in these two environments (Russell, 1999). However, much less research has examined the relationship of student characteristics to performance in each of these teaching models. Two characteristics which are related to both academic and work performance are goal orientation and self-efficacy, both of which are related to motivation.

Goal Orientation

Goal orientations include learning goal orientation and performance goal orientation (Ames, 1992; Ames & Archer, 1988; Dweck & Legget, 1988). Each has different aspects of cognition, affect, and behavior (Harackiezicz, Barron, Tauer, & Carter, 2000). One of the significant points of these two approaches is that they influence the amount of effort expended (Ames, 1992).

Learning goal orientation uses the self as a referent and focuses on learning and developing skills (Harackiewicz et al., 2000). It emphasizes adaptive learning behaviors, task involvement, seeking challenges, and deep processing of course material (Ames & Archer, 1988;

Nolen, 1988). With learning goal orientation, competence is developed by acquiring and mastering new skills and situations (Dweck & Leggett, 1988).

Performance goal orientation focuses on demonstrating competence by comparing one's performance to that of others—hence a competitiveness orientation. (Ames & Archer, 1988; Harackiewicz et al., 2000). Performance orientation utilizes maladaptive learning strategies by avoiding challenge and risk of failure. To the individual with a performance orientation, failure indicates poor ability. S/he perceives ability as fixed and views high effort as an indicator of low ability. A student with a performance orientation uses surface level processing (Nolen, 1988) and validates competence by seeking favorable judgments and avoiding negative judgments (Dweck et al. 1988).

Research has generally found that learning goal orientation leads to improved performance, while, with some exception, performance goal orientation does not (Bergin, 1995). Learning goal orientation has been found to be related to exam scores, while performance goal orientation generally has not (Button et al., 1996; Phillips & Gully, 1997). A study by Stevens and Gist (1997) determined that learning goal orientation training led to planned use of greater effort in the future, and VandeWalle et al. (1999) demonstrated that learning goal orientation was related to sales performance.

However, in some cases, performance goal orientation has been found to be related to grades. These results have been found with course grades, semester grades, grades in the same discipline courses, and grade point average after three semesters (Harackiewicz et al., 1997).

Self-Efficacy

According to Bandura's (1986) social cognitive theory, learning is a continuous process in which behavior is influenced by one's cognitions. One important group of cognitions is self-efficacy. Self-efficacy refers to one's confidence in being able to accomplish a specific task, or one's perceived ability to perform a specific task (Gist, 1987). It regulates behavior by determining task choices, effort, and persistence (Wood & Bandura, 1989). There is a significant amount of research demonstrating that self-efficacy is a consistent predictor of academic achievement (Ames & Archer, 1988; Pintrich & DeGroot, 1990). Self-efficacy has also been shown to predict performance in work situations (Frayne & Geringer, 2000; Latham & Frayne, 1989).

DESCRIPTION OF THE STUDY

The primary purpose of this study was to identify the predictors of academic performance in online courses and in traditional classroom courses and to determine if these predictors were the same in both teaching environments.

Sample

The sample consisted of 192 students taking junior or senior courses in the School of Business at a state university in the southeastern part of the United States. All 192 students had taken traditional classroom courses. Of these students, 130 had taken at least one online course.

Measures

The criteria were the students' grade point averages for online courses and their grade point averages for classroom courses. These were collected from sources independent of the student.

The independent variables were a scale measuring self-efficacy and a scale measuring learning goal orientation. Learning goal orientation was selected because past research had consistently found learning goal orientation related to academic performance while performance goal orientation, with some exceptions, had not been associated with academic performance.

Self-efficacy was a seven-item measure based on a survey and guidelines recommended by Bandura (1996). Its reliability as measured by Cronbach's alpha for this measure of self-efficacy was .88. Measures of the two goal orientations were included in a survey developed by Helmreich and Spence (1978). The reliability of the learning orientation, as measured by Cronbach's alpha was .77. A term measuring the interaction between learning goal orientation and self-efficacy was the third predictor examined in this study.

FINDINGS

Backward stepwise multiple regression analysis examined the relationships between online course grade point average and classroom course grade point average and learning goal orientation, self-efficacy, and the interaction of learning goal orientation and self-efficacy. A difference in predictors of the two measures of academic performance was found. Of the three predictors, only self-efficacy was significantly related to classroom course grade point average. Using a two-tailed test of significance,

significance was found at p<.001 (n=184). The multiple correlation coefficient was .356.

The regression analysis of the online course grade point average also found that self-efficacy was significantly related, as well as learning goal orientation and the interaction term of mastery and self-efficacy. All predictors were significant at p≤.02 (n=130). The multiple correlation coefficient was .515.

CONCLUSIONS AND RECOMMENDATIONS

There appear to be differences in variables which predict the performance of students' online course performance and the performance of those in traditional classroom courses. Specifically, for online courses, a learning goal orientation, self-efficacy, and an interaction of these two appear to be good predictors of student grade point average. On the other hand, the sole statistically significant predictor of classroom performance was found to be self-efficacy; learning goal orientation and the interaction term do not appear to be as related to classroom performance as to online learning performance.

There are several implications for these findings. First, there are differences in students who perform well in classroom courses and online courses. While this finding seems obvious, there has been little research to support this belief. Armed with this information, colleges and universities can take at least two approaches. One, students can be counseled and encouraged to take one type of course or the other to improve their chances of success. Two, both self-efficacy and goal orientation can be altered through training (Mathieu & Martineau, 1993).

Faculty can improve self-efficacy by providing students with opportunities at their ability levels which allow them success on tasks with gradually increasing challenge. For those who are particularly interested in online courses, pre-training to increase self-efficacy and a learning goal orientation can be coupled with faculty who take the necessary steps to structure tasks to improve these characteristics.

A second major implication is that, by improving students' skills in these areas, college and universities are also providing them with skills that research has shown to be related to on-the-job performance. In summary, higher education institutions, by providing training in these areas, can help students develop skills which will serve them well both in an academic environment and in their careers.

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THE VIRTUAL ANESTHESIA MACHINE: AN EDUCATIONAL EXPERIMENT IN INTERACTIVE, REAL-TIME WEB SIMULATION AND PHILANTHROPY

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INTRODUCTION

Traditional didactic materials such as textbooks are often primarily text interspersed with static pictures and graphics. Descriptions based on text and static graphics of complex, inter-related processes that evolve and branch over time may be tedious and hard to follow for visual learners who respond better to graphical interactive representations (Ohrn et al., 1997). Static graphics lack the elements of time and interactivity. Additionally, some processes, such as gas flow, are by nature invisible and thus made harder to visualize and understand (Lampotang et al., 2000).

With the introduction of the personal computer (PC), computer-based, electronic training became popular. Some earlier computer-based training consisted primarily of glorified, electronic "page turners," based on a textbook metaphor. That is, pictures and text from textbooks were reproduced in electronic format and, effectively, the power of the PC was used mainly to decode the bits comprising the data and "turn the pages". Arguably, computer-based training implementing a textbook metaphor did not fully exploit the power of the PC and may have been a confounding factor in studies that found no difference in learning between computer-based training and traditional didactic materials (Vichitveipaisal et al., 2001).

With the advent of the Web, some educational Web sites replicated the textbook metaphor. While placing educational material on the Web certainly increased accessibility, it can likewise be argued that the potential of the Web may not have been fully maximized with "page turning" Web sites. Other reasons why some educational resources failed to reach large audiences include: 1) they were not originally designed for Web dissemination and could not be readily posted on the Web; 2) they charged a fee for use, excluding potential users without financial means; and 3) they were platform specific and could not be used on both Mac and Windows PCs (Lampotang, et al., 2000).

The major purpose of this paper is to describe the development, implementation and results of the use of a simulation designed to counteract problems identified above in the use of computer-based electronic training tools. The study provides not only the data collected in usage, but also describes the outcome of a specific funding scheme for such developments.

DESCRIPTION OF THE STUDY

Background Information

Anesthesia machines are used to induce and maintain a state of general anesthesia so that surgery may proceed with a minimum of pain. Patients are, during certain phases, utterly dependent on the anesthesia machine to breathe for them and failure or misuse of the anesthesia machine may lead to patient harm. Anesthesia machines therefore function as life support systems and as such, it is essential for users to have a sound understanding of the anesthesia machine and its potential failure modes.

Obstacles to understanding the anesthesia machine include: 1) gases used in anesthesia are invisible; 2) piping is often hidden and it may not be obvious how components are interconnected; and 3) electronics and software are integrated with the basic pneumatic system, making the anesthesia machine even more complex.

Objectives of the Study

The objectives of the study were twofold. The first goal was to create an engaging, interactive, real time, Web-based simulation of an anesthesia machine that addressed the previously stated obstacles. Secondly, this study would explore the viability of a funding model based on the hypothesis that free, high-quality materials would attract heavy traffic that would in turn attract sponsorship and donations.

Development of the Simulation

To address these objectives, the "Virtual Anesthesia Machine" simulation, accessible at http://www.anest.ufl.edu/vam, was created using Director 8.0 (Macromedia, 2001). The Virtual Anesthesia Machine is an interactive, real-time, animated simulation of gas flows in a generic anesthesia machine, based on the premise that *if a picture is worth a thousand words*, then *an animation is worth a thousand pictures* because the crucial dimensions of time and interactivity are added.

Instead of complex, dimensionally accurate drawings of an anesthesia machine, the Virtual Anesthesia Machine presents a simplified, yet conceptually accurate, mental model designed to help viewers appreciate and retain basic concepts. To assist visualization, gas "molecules" are made visible and color-coded (US/ISO gas color codes). Mathematical models drive the simulated flow of gas molecules.

Users can adjust 30 controls and observe in real time the essential effects of their interventions on gas pressures, flows, compositions and volumes (lung, bellows and breathing and scavenging bags). The simulation can be paused to capture fleeting events that may be easily missed.

Machine faults that represent potentially life-threatening situations can be simulated. Gas molecules can be made invisible for teaching situations where gas color-coding interferes with the learning process because color-coding would give away the fault being simulated, e.g., blue nitrous oxide "molecules" flowing in a green oxygen pipeline.

On-line help to use the simulation is available as an animated tutorial. The simulation features Arabic, Chinese, Dutch, English, French, German, Italian, Korean, Russian Spanish or Turkish legends and represents roughly seven person-years of work.

The Virtual Anesthesia Machine is made available only via the Web. The Macromedia Shockwave Web player (a free download, if not already pre-installed on newer PCs) is required to view the simulation from the Web. Upon first use, user registration is required. Instructions for off-line use at teaching locations without Web access are provided at the site.

Charges for Use and Funding

When exploring different modalities for disseminating the simulation, a deliberate decision was made to engage in an experiment in Web philanthropy. Consequently, all materials on the Virtual Anesthesia Machine Web site, including the simulation, were made available free of charge so that financial means would not be a barrier, especially for students from less developed countries.

Because no income to fund continued development of the Virtual Anesthesia Machine project would be generated from charging for use of the simulation, an alternative funding model based on leveraging traffic at the Virtual Anesthesia Machine Web site into institutional and corporate sponsorship and individual donations was adopted. A working assumption was that manufacturers of anesthesia equipment and drugs would be willing to use part of their public relations budgets to sponsor a high traffic Web site because they would be afforded additional visibility and would share in the goodwill associated with distribution of free, high-quality educational content. The stated goal was that the Virtual Anesthesia Machine project would be financially self-sufficient through funds generated by sponsorship and donations.

Measuring Traffic on the Website

Because the Virtual Anesthesia Machine funding model depended on leveraging traffic into sponsorship, it was essential that visitor statistics be accurately compiled and trusted by potential sponsors. Webalizer 2.01 (Barrett, 2000) was installed on the server hosting the Virtual Anesthesia Machine Web site to monitor traffic on the site. Based on credibility criteria, Webalizer was selected because it did not artificially inflate hits when compiling visitor statistics. For example, request of one web page containing five graphics and audio clips would be counted as one hit by Webalizer instead of five, as certain other monitoring packages might report.

Users were prevented from saving the simulation to local hard disks in their PCs because that would provide a "download once, use many" capability such that Webalizer statistics would underestimate actual use frequency. To obtain a hit for each use of the Virtual Anesthesia Machine simulation, the simulation was implemented in such a way that it must be downloaded from its Web site for each session. Users have also been required to enter into a legal contract that clarifies that the Virtual Anesthesia Machine is free to use, but not free to copy onto any media, including hard disks, by clicking on an "I agree" button. Users who have not agreed to the contract have been denied access to the simulation.

FINDINGS

Monthly traffic on the Virtual Anesthesia Machine Web site for November 2002 was 137,174 hits and the total for the five month period of July-November 2002 was 516,016 hits. The number of registered users, to date, with genuine e-mail addresses is 6,951. User feedback has been unanimously positive—two representative samples follow:

> *What a great idea! At last truly useful medical education on the net...* by a resident at Norfolk and Norwich University Hospital, United Kingdom.
>
> *This is one of, if not the best, Web-based educational resource I have ever encountered. Keep up the great work!* by a veterinarian at the Armed Forces Institute of Pathology.

Since monitoring of Internet search engine listings began in March 2002, the Virtual Anesthesia Machine Web site has remained the top entry when performing a Google (www.google.com) search on "anesthesia machine", establishing the site as the Internet portal for learning about anesthesia machines. Olympio (2002) also recently gave an overall favorable review of the site.

In addition, use of the Web has facilitated version control and allowed instant dissemination of new Virtual Anesthesia Machine versions (6 versions in 2002) as soon as they are completed, for minimal distribution cost. Emphasis on graphics, instead of text, significantly lightened the translation load and facilitated finding volunteer translators.

Sponsorship currently covers 10% of the annual costs of updating content (including the simulation) and maintaining the web site. Donations total only $10.

CONCLUSIONS AND RECOMMENDATIONS

Preliminary data and unsolicited user feedback suggest that interactive, real-time Web-based simulation driven by mathematical models appears to be an efficient, engaging and popular means of learning. It remains to be established whether the unanimously positive user feedback is due to the philanthropic approach or the content or both. A study by independent, third party, education experts comparing a computer-based training method using animated simulations driven by mathematical models such as Virtual Anesthesia Machine vs. traditional didactic materials is recommended.

In the short term, the philanthropic funding model has been a failure, funding only 10% of annual operating costs; long-term viability remains to be seen. While the technical objective has been achieved, the other stated goal of financial self-sufficiency has remained elusive. It may be difficult to balance a philanthropic policy with fiscal autonomy, especially in the current economic downturn.

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VENTURES IN DICHOTOMY:
RIGOR AND TOLERANCE
IN THE EDUCATION OF BEGINNERS

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INTRODUCTION

> To instruct someone ... is not a matter of getting him to commit results to mind. Rather, it is to teach him to participate in the process that makes possible the establishment of knowledge...[It is] to get a student to think for himself ...to take part in the process of knowledge-getting. Knowing is a process not a product. (Bruner, 1996, p. 72).

Educating beginning students in any field of study entails reaching a delicate and difficult equilibrium between two contradictory positions: while maintaining the rigor of high aspirations that expect all students to exhibit sophistication of concerns and executions, the teacher must also remain aware that each student's process is unique and fragile. This condition summons the teacher to tolerance (not to be confused with indulgence) and much patience.

The effort to achieve this critical balance may easily become ineffectual if s/he attempts to maintain a homogenous and arbitrary progress in the studio, the laboratory, or the classroom. The usual consequence is that the most competent students in the early stages dictate the pace for everyone else. The artificiality of this condition tends to hinder the sustained engagement (so indispensable for the creative act) by the rest of the students. This paper is an attempt to examine the critical role that time and pacing play in the early stages of skill acquisition and its subsequent development.

It is well-known to all who have taught beginners that the processes that initiate and expand the mental maneuvers responsible for innovative and creative thinking are not swift. They often seem chaotic and subject to agonizing missteps. Any progress in this domain is rarely a matter of quantum leaps, but most'often the result of a few tentative steps and a myriad of frustrating falls. Thus, it can be argues that, even though the learning process moves forward, its coherence and logic can only be perceived backwards.

In addition, it is suggested that the effectiveness of any pedagogy should not only be measured by the excellence of the works executed by those three or four strong students that invariably enroll in any class or studio but, even more so, by the ability to arouse and sustain the creative impulses in the weak ones. It's important that they too can eventually aspire and execute works of value. It is the premise of this essay that the exercise and full development of the creative agility of all students takes time, plenty of time. In this most critical matter, to exaggerate is preferable than to neglect.

The Theoretical Model

At the School of Architecture and Design at the University of Louisiana, a decade-long effort to craft the pedagogical intentions and the operational framework of the beginning design studios has been focused upon the site of learning—the student. Towards this end, the faculty members involved in this endeavor have been continually informed and stimulated by Jerome Bruner (1966), the pioneer in the field of education. One of Bruner's major contributions has been the investigation of the dual theme of how children—the ultimate beginners—learn, and how they can be helped to learn.

Bruner's insights—in particular those that address how young children's instinctive will-to-learn can best be directed and amplified–have been found to be pertinent and easily transferable in the designing of a pedagogy that is aimed exclusively at beginning design students. In his landmark book "Towards a Theory of Instruction," (1966) he defines instruction as the assisting and facilitating of the processes whereby human beings go from a state of utter helplessness to one of control. The process through which this takes place he describes as "a staircase with rather sharp risers" (p. 27), and the dynamic as being a matter of spurts and rests: "The spurts ahead in growth seem to be touched off when certain capacities begin to develop. And some capacities must be matured and nurtured before others can be called into being [emphasis added]"(p. 27). This observation, coupled with the awareness that most beginning students differ greatly in terms of learning-style, rate of growth, and entry level of competence, makes a strong case for reassessing the critical role that time and pacing play in facilitating the proper integration of the long sequence of acts that delineate the educational intentions of any curriculum.

THE FOUNDATION PROGRAM

The School of Architecture and Design, cognizant of the decisive role time plays in the beginning design experience, has structured its Foundation Program as a five-semester sequence. This represents half of the five years that are required for a bachelor degree in architecture. The Foundation can be seen as an orchestrated set of pivotal experiences which begin in the first year and are concluded at the end of the first half of the third year. This strategy originates from the premise that learning depends on the internalization of experiences. Therefore, the main objective has been to provide all students with a studio environment which is most conducive for this complex and delicate internalization process to occur in its totality. Most importantly, project formulations are designed deliberately and intentionally to foster the gradual progressive development of each student.

This objective has also led the faculty to formulate projects that are semester-long. These are subdivided into three or four subprojects. Conclusions of each become the generators for the next one. This approach insures that inquiries about essential design issues are dealt with gradually and progressively within carefully chosen parameters. This serves the purpose of limiting and focusing each project's content in order to insure that mastering of basic skills take place prior to introducing more complex ones.

THE HEURISTIC PROCESS

The major condition for activating exploration ... in a task is the presence of some optimal level of uncertainty. Curiosity, it has been persuasively argued, is a response to uncertainty and ambiguity (Bruner, 1966, p. 43). Like Bruner, the foundation faculty identifies curiosity as the "energy" that drives genuine search, exploration, and discovery; therefore, its arousal is considered paramount. It has been found that this is best achieved in an environment which is heuristic in nature, that is, studios in which the primary impetus is exploration and discovery.

Project formulations are conceived as heuristic tasks; in other words, well-crafted, enigmatic and ambiguous questions. The heuristic process essentially operates as a cyclic and nonlinear network in which students seek to synthesize whole yet incomplete formulations during all of the phases of a project. It is characteristic of this approach that throughout the entire process, product and content are entwined, interacting continuously. This way of designing works on the following premise: one must try to design a "thing" in order to know how to design that thing or even to know what it might possibly be.

The heuristic approach is echoed by Paul Feyerabend (1975):

> Creation of a thing, and creation plus full understanding of a correct idea of the thing, are very often parts of one and the same indivisible process and cannot be separated without bringing the process to a stop ...[This is a] process [that is] guided by ... a vague urge, by a "passion" (p. 26).

The primary aim for the Foundation Studio is to foster conditions under which the student is growing in confidence and feels free to explore and risk, fail and discover. Fundamental in assisting this objective is to ensure—as Bruner promotes—that the benefits of exploration always exceed the risks involved. They are to be valued above any other objective or criteria.

> The maintenance of exploration, once it has been activated requires that the benefits from exploring alternatives exceed the risks incurred...That is to say, the consequences of error, of exploring wrong alternatives, should be rendered less grave.
>
> (Bruner, 1966, p. 43)

This teaching model displaces the teaching-style which coerces students into a fearful, dependent, and submissive "tell me what you want me to do" style of learning, and replaces it with a summons for all students to discover a personal way of working, using their own history and individual ways of apprehending and imagining the world. The task in this context is for faculty to initiate and cultivate the dialogue between the student and that which has aroused his or her curiosity and provoked insight.

This educational strategy requires that the teacher accepts and participates in the unique process of each student in the studio. It implies a sensitive openness to the way in which each project unfolds. The critical task is to reach through the temporary discord and naiveté and help identify what merits further development.

It has been found that team-teaching and periodic group reviews are the best venue to foster a more constructive exchange of ideas from all participants. This approach amplifies the scope of the project on a daily basis due to the diversity and intensity of the questioning, and the ensuing argumentation by students and faculty. The teacher's effectiveness in participating in this process is dependent upon a stance that is both critical and intentional while remaining patient and open to all the particular and diverse interpretations unfolding (or not) throughout the studio.

EXPLORATION AND UNDERSTANDING

The reward of deeper understanding is a more robust lure to effort than as been realized (Bruner, 1966). It is the opinion of the Foundation faculty that students of design must learn at the onset of their design education to engage big ideas and formulate intelligent and ethical positions of their own concerning matters of significance. Project formulations are simple yet germane. Their primary intention is just to provide the stimulus to initiate the first stage of the dialogue. Additional information and time are carefully assessed and supplied. This is very important since undue complexity, and too much information often overwhelm and overload the student's capacity to apprehend, order and play in the situation being explored. On the other hand, overly reduced content may fail to provoke curiosity and significance. Most importantly, the teacher must be always aware that an increase of programmatic content that is appropriate for some students may, at that particular time, do damage to the development of others who are still groping with a previous phase.

At the onset of any design investigation in any Foundation studio, rough approximations are developed from major themes or issues which have been discovered and engaged by the student. Even in its beginning stages these are considered whole things. Their value in their embryonic stages is to enable each student to identify, however vaguely, the primary factors at the heart of the task. Based on the agenda these constructs set up, the ensuing explorations by the student expands and amplifies the programmatic intentions as well as the clarity, complexity, and rigor of the executions.

The above cycle is repeated and elaborated throughout the life of the project, each time benefiting from a more informed base. A sense of progress is viewed in terms of iterative understandings of the intentions being sought and developed.

The conclusion of a project is never rushed arbitrarily but allowed to mature; long range due dates have been abolished (as have been grades, except for finals). Instead, students are required to bring new and updated work each time the class meets. This approach ensures that a work discipline is acquired by the student, one which is consistent and which addresses issues and questions in a timely manner.

The trajectory that eventually yields the conclusion of a project is rarely like a pine tree pointing in a single direction. Even at its best, it is more like a live oak with a dozen branches going in all directions. Or, it is like taking a walk with a four year old: it is a venture that may have a destination, but the path is one that "zigs and zags" and meanders on the way there. A person can only invite frustration if he tries to keep the child from getting sidetracked, and to make him or her walk straight ahead. This is exactly what the faculty once did in the beginning studios. They limited the investigations in order to achieve ends other than initiating and sustaining the creative impulses of all students.

Creative processes are more like contained chaos, or a chaos that contains order. The design instinct is a primal, creative force which by design moves and grows and accrues complexity and clarity by repeatedly falling apart. Prior to these pedagogical changes, the faculty denied the students the thrill of the full and furious ride of a germinal idea at work. They preempted the search, and thereby concluded projects prematurely, settling for solutions that did not deserve to be called conclusions.

It is now agreed that a single project that is allowed to exhaust and transform its creative force into the serendipitous events of the search is worth immensely more than three or four truncated ones executed in the same length of time. There is no substitute for the genuine pleasure felt by a student who, once s/he has been lured and energized by the uncertainty of a task, is allowed to sustain his or her attention over a long, loosely connected sequence. This is what every beginning student must experience. This alone deserves the teacher's unreserved generosity; at the School of Architecture and Design, it holds primacy over any other objective.

MEDIA AND DIGITAL TECHNOLOGY

At the onset of the beginning students' design activity, it has been found that physical model-making, and full-scale constructions in the woodshop are the most effective media to explore, stimulate, and communicate their formulations. Free-hand drawing and color media are introduced next as a means to expand the findings of their three dimensional modeling. Digital media is introduced last in the fourth semester of the Foundation. Model-making, free-hand drawing, and digital technology (Photoshop, PowerPoint, and Form Z, primarily) must be fully integrated into each student's processes as a prerequisite for exiting the Foundation Program. All classes and studios in the Foundation use Blackboard.

CONCLUSION

> You are so young, so much before all beginning, and I would like to beg you...to have patience with everything unresolved...and try to love the questions themselves...[design] your way into the answer.
>
> (Rilke, 1984, p. 34)

Rigor and tolerance need not be mutually exclusive in the classroom or studio. More than ten years of enacting this approach have confirmed that together they can be seen as the parenthesis that hospitably and generously cradle that fragile, but potentially world-transforming creative force of each student. The space that is cleared and framed by the dichotomy is like a matrix that harbors every beginner's initial fumbling: that configuration half-perceived, a relation faintly grasped, a concept newly emergent. This embryonic "thing" must be simultaneously nurtured and challenged, invited and stimulated, oriented and dared until it undergoes the full range of the push-and-pull of the evolutionary havoc that is required for yielding that which is worthy of being considered a conclusion.

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LEARNING CUBES:

A MODEL FOR ONLINE EDUCATION

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INTRODUCTION

Online learning is a relatively youthful field. As faculty struggle with decisions about how to structure online courses for collaborative learning, faculty perspectives of successful strategies can provide valuable insights for decision-making. Few studies have been conducted that examine the impact of the collaborative teaching/learning strategies in the distance education setting (Hardwick, 2000). This paper presents general research findings pertaining to collaboration in online learning along with personal insights into what makes a project-based online assignment successful as a collaborative learning experience.

While online learning offers administrators, faculty, and students many advantages over traditional campus-based learning, problems do exist. Attrition is one such problem for online learners. Attrition is brought about in large part by a sense of isolation (Adelskold, et al., 1999). One teaching/learning strategy, which can improve this sense of isolation, is cooperative or collaborative learning. Collaborative learning involves students in social communication as groups work together to discover knowledge, think critically, communicate effectively, reflect, and solve problems.

Social interaction among learners plays an important part in the learning process; in fact, it can have a significant impact on learning outcomes. (Berge 1995; Eastmond & Ziegahn 1995; Jonassen, et. al. 1995). Students in online education programs, though separated spatially, can gain a sense of community as they distribute and simplify ideas, actively contribute to a team, and cooperatively solve problems (Cecez-Kecmanovic & Webb, 2000).

With progress in telecommunications and computer technologies, it is now possible to offer collaborative learning experiences in a cost-effective way. In the past, collaborative approaches to distance learning were limited by the cost and sophistication of the technology. Recent advances in technology coincide with a general shift in educational theory to a collaborative origin of learning, which recognizes the learner's need to share control and assume responsibility for problem solving in the context of a peer group (Anderson & Garrison, 1998).

Collaborative learning is an outcome of cooperative learning, in that students must develop cooperative learning skills in order to use them in self-directed, high-performing teams. These collaborative groups conduct free investigation and members jointly discover and solve problems. Success in cooperative learning is grounded in the skills students develop within the context of the academic organization provided by the facilitator/instructor. More importantly, in distance learning, students must possess or develop the technical skills necessary for online communication, as well as acquire and practice social skills necessary for collaboration (Kemery, 2000).

Cooperative learning involves requiring individuals to be accountable so that each participant does a fair share. It involves both effective cooperative social skills and effective and appropriate communication skills to bring the task to completion. Research shows that such cooperative learning practices lead to more efficient and effective processing, increased achievement, positive relationships among students, and efficient exchange of information (Johnson, et al., 1997).

OVERVIEW OF THE MODEL

Since collaborative learning is an outcome of cooperative learning, Learning Cubes is a product of both teaching strategies. Learning Cubes is another name for peer learning and teaching, peer tutoring or team learning. The major difference between these learning strategies and Leaning Cubes is who is delivering and the amount of information delivered to the student at one time.

With Learning Cubes, one student will take responsibility for a certain prescribed amount of information and teach it to a small assigned group of students. This prescribed amount of information disseminated to the group will be small, challenging, and productive. Prescribed information can be layered from assignment to assignment, permitting connections of previous taught material to be made while threading new ideas or skills to be learned from the group.

Group size for the learning cube is usually small—between two or three students. This size increases effective interaction between students while extending the learning process. Some positive interdependence is built into the experience so that members need one another to accomplish common goals of constructing knowledge.

Learning Cubes, team learning, and peer tutoring work best for some students but may not work well for all. However, in most cases some students increase learning through these methods while not hindering the learning of others (Larson, 1984; McKeachie, 2002). Instructors, however, will need to spend more of their time in the role of facilitator, organizing students, managing students, and helping students work together effectively.

TESTING THE MODEL

Overview

Within a faculty development classroom, nine newly hired McLennan Community College educators participated in an online collaborative project-based assignment. This faculty development was mandatory for all newly hired instructors. The educators taught in various fields of study (nursing, construction, music, business, art, psychology, English, science, and math).

All faculty were given two preliminary workshops using Blackboard, an online course management system. The workshops provided basic knowledge of navigation skills needed to effectively complete the assignment. After completion of the workshops, the faculty (students) were randomly assigned into groups of three making a total of three groups.

As students, the instructors were given two weeks to complete the assignment. As learners via the Web, the instructors could interact with one another from different geographical locations either in synchronous (real time) or asynchronous (delayed) mode via text-based communication for the purpose of dialogue. They also had the option of working as a group within a classroom setting to implement the tasks of the assignment.

Each group elected a person who would become the teacher for the group. Each activity covered small amounts of content which could be covered successfully within a few minutes. All members of the group had to complete the activities assigned.

Procedures

Within Blackboard the interface structure was designed for ease of use. There were eight categories of interactive buttons designed on the left side of each Web page. The categories included Announcements, Course Information, Course Documents, Assignments, Books, Communication, Virtual Chat and External Links.

As users opened up Blackboard they would automatically find themselves at the Announcement Web page. Carefully designed instructions would direct users to the Pre-activity Assessment, Course Information, Course Documents, and then the Assignment Web pages. At the Assignments Web page users would be prompted (if they had not done so) to complete the Pre-activity Assessment.

The Assignment page instructed the users to select one group member to be the instructor. The instructor of the group had the responsibility to demonstrate to the other members what s/he learned from watching a streamed movie file. The streamed movie was a very short video tutorial about how to make a Web page using a Word document. The goal was clearly stated; after the instructor viewed the movie file, s/he would decide how best to instruct the group members to make a Web page using Microsoft Word.

As group members mastered making a Web page using Word, each member of the group had to demonstrate new knowledge by completing his or her own HTML documents. Completed assignments were then forwarded to an e-mail address on the Assignments Web page.

Assessment

For assessment purposes, students were required to demonstrate newly learned skills in two pieces of work:

1. after learning how to create a Web page from a Word document, each student had to create a HTML document reflecting the pros and cons of cooperative learning

2. Each student also had to create another HTML document reflecting upon items given on the pre-survey.

PRE-ACTIVITIES

For feedback purposes, each member of the group was asked to participate anonymously in a pre-activity assessment. The survey was designed to stimulate thoughts concerning the topics of cooperative learning. All survey questions were designed using Blackboard's management system. At the end of the required assignment, this survey was used as a reflective evaluation. The following questions formed the pre-activity assessment:

1. Do you feel that high quality learning can take place without going to a traditional educational facility? Why or why not?

2. Do you like the idea of sharing your work, life and educational experiences as part of the learning process? If your answer is yes or no explain why?

3. Do you think it is possible for increased learning to take place when work/ knowledge/life experiences are shared with peers? Why or why not?

4. Do you accept the value of facilitated learning as an advantage over the more traditional lecture-based learning process? Why?

5. Have you incorporated cooperative learning into instructional methods? If so, how?

Notification of the survey was linked in two general Web pages, within the Announcements page and within the Assignments Web page. Both notifications had a brief introduction and informed individuals about directions. Instructors were requested to complete the survey and that confidentiality was assured. After each survey was taken, access to it again was denied. This operated as a check against respondents filling out the survey more than once.

RESULTS OF FACULTY INTERACTION

Pre-Activity Assessment Results

Question 1--Do you feel that high quality learning can take place without going to a traditional educational facility? All except two instructors said yes to this question. Most faculty members felt that high quality learning outside the traditional educational facility happens all the time such as people learning at the work place, reading/learning at home, or people learning about a new sport.

Many instructors still feel that there is distinct value in face-to-face communication with students and teachers. Some instructors felt that only technology literate students could benefit from online learning, while others said, "it seems that online learning can be a very viable option for people to receive quality education." One instructor said, "the more options people have the better the opportunity to learn." Another faculty member responded, "I think it depends on two things, the motivational level of the student, and the learning style of the student.

Question 2—Do you like the idea of sharing your work, life and educational experiences as part of the learning process? Most instructors commented positively. All instructors felt that their rich learning experiences should be shared with their students. One faculty commented, "yes, I think that part of my teaching style is to bring a part of myself to the classroom and the material I teach." Another faculty member said, "yes, because I have had what I feel is such a rich set of learning experiences, I hope that the people I'm around could share that as well." A few faculty commented, "not completely, everyone has a certain comfort level and if forced to go beyond that people will withdraw and cease to learn."

Question three--Do you think it is possible for increased learning to take place when work/knowledge/life experiences are shared with peers? All respondents had positive statements about this question. "If the right framework is established, and the group is trained to use the experience in particular ways, the sharing with peers can be rich," said one respondent." Another respondent stated, "yes, increased learning in this instance may relate to the real world." Another said, "certainly, my knowledge has grown just listening to others and their experiences."

Question four--Do you accept the value of facilitated learning as an advantage over the more traditional lecture-based learning process? The comments for this question were mixed. For the most part, many instructors felt that it would depend on the circumstances. One respondent stated, "it really depends on the student. Some are simply not grounded enough or confident enough to be self-motivated." Another faculty member said, "I know of many students who are not self-motivated; this style of teaching will not work." One respondent said, "I believe lecture holds a valued place in higher ed." Lastly, a respondent stated, "The individual becomes engrossed in the learning process by sharing his or her own ideas. This integrates the individual into the instructor and the learner at the same time."

Question 5--Have you incorporated cooperative learning into instructional methods? This question also received mixed responses. Five instructors answered positively saying that they have used this teaching strategy before. One faculty member stated, "I teach writing which pedagogically and practically means students interacting with others." Another responded, "Yes, I have assigned students into pairs to work on assignments. I have also asked for group presentations."

Some faculty used cooperative learning a little, while others did not use it all for instruction. These latter respondents stated, "Not too often. The nature of my courses thus far have not been very conducive for cooperative learning methods." Two faculty members flatly stated, "no."

Post Survey

At the end of the two weeks, all instructors involved in the project-based assignment were given a simple post survey. The post survey contained open-ended questions about the direct impact this assignment had on the users as teachers. The questions were:

> *1. How were you actively engaged?*
>
> *2. What aspect of the project-based assignment will you immediate incorporate into your teaching?*
>
> *3. What was missing that would make this project-based assignment more valuable to you?*

BEST COPY AVAILABLE

Post-Activity Results

Most instructors completed the online collaborative project-based assignment within two weeks. Instructors who had experience using computers or the software program Blackboard had finished the assignment early. Faculty who had limited computer experience took the full two weeks to complete.

Question 1--How were you actively engaged? Although the participants did not choose their own group members, their post survey answers indicated that they were actively engaged in the project-based assignment. This was primarily because of the pre-activity assessment, the watching of the streamed tutorial movie, and the engagement of making a HTML document from within a Word document.

Positive comments stated, "I was actively engaged using the presentation;" "I was actively engaged by creating my own Web page;" "with cooperation from colleagues, i created a Web page;" "I learned more about my ability to use Blackboard." Negative comments included "just confused about how to get in;" "the topic was not something I understood;" "I had to cooperate . . . I think."

Question 2--What aspect of the project-based assignment will you immediately incorporate into your teaching? Most commented positively. One faculty group member stated, "I now know what it is like to be a student of an online class. I think I will focus on preparing supplemental materials for my online site to accommodate my students." Another instructor said, "I will attempt to use more cooperative learning."

From the instructor comments it was clear that not all perceived working in Learning Cubes to be valuable. Some inexperienced users did not have enough time to work with the software program Blackboard, while other groups did not have enough members experienced to work with technology. One instructor commented, "I just couldn't figure it out to immediately incorporate it into my teaching." Others stated that they would not attempt to incorporate this assignment into their teaching methods.

Question 3—What was missing that would make this project-based assignment more valuable to you? One instructor commented, "perhaps a little more detail on the value of cooperative and its integration to be used in web pages." Two instructors said, "I would have liked to learn this from a traditional classroom setting." While most instructors commented that nothing really stood out, a few still had problems following directions or working with the methodology.

PEDAGOGICAL ISSUES

Cooperative or active learning methods may not be appropriate for every institutional setting. For new teachers beginning to implement cooperative strategies, the idea of using students' as instructors teaching small amounts of information may be somewhat intimidating. If teaching specific content or cognitive processing, each session must facilitate an environment conducive to collaboration.

Factors in the Success of Learning Cubes

Content. For learning cubes, team learning, peer tutoring to work, the groups and the content delivered must be small and effective. Further, the team project or assignment must be challenging enough to require teamwork. Groups need to feel that they are reliant upon one another in order to be successful. Members will be more likely to appreciate each other's unique contributions if reliance is a factor.

Guidance. To have effective group members, instructors should provide guidance for students on how to work successfully in collaborative teams. The social characteristic of successful teams should be clearly taught and not assumed.

Identification of Roles. Clear and distinct roles for each member can aid in the groups communications. Among group members, a clear understanding of assignments and work responsibilities can make task management easier for each student. Assignment responsibilities are directly related according to each group member's role. Tasks and authority in the given areas of responsibility must be well defined. Individual team members may be given more decision-making authority in their various areas of expertise.

Communication. The key to collaboration is communication. The spirit of project-based, online collaborative learning is communication because positive group structure and learning occur through on-going discussion (Kemery, 2000). Asynchronous communications can be employed for much of the collaborative effort, through e-mail with attachments and private forums. In addition, synchronous private chat rooms can be used successfully to facilitate collaborative learning (Lai, 1999). Synchronous communications are critical for establishing team deadlines, responsibilities, roles, goals, and for deciding differences of opinion. Group chats are also important for structuring relationships, helping one another supporting momentum and celebrating accomplishments.

As is true of all courses, it is best to begin each collaborative session with a clear understanding of course content and requirements. Clearly stated assignment requirements give group members a common starting point and provide a structure upon which to build. They also assist students with the preparation of collaborative work responsibilities.

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Courseware Design. In planning courseware design for online learning the instructor should provided the following:

> *Effective technology workshops for students if new hardware and software will be used in the session*
>
> *A technology help desk with appropriate days and times users can receive help*
>
> *Purposeful asynchronous and synchronous help sessions*
>
> *Creative chat sessions for office hours with appropriate days and times.*

Additionally, flexibility in meeting assignment requirements facilitates students to develop ownership of the assignment, aids in the development of critical thinking and problem solving skills, imparts room for originality, and encourages a sense of group individuality and unity.

If subject matter is very large, the instructor, by effective layering a task, assignment, or project, can help groups manage challenging jobs. This can encourage groups to keep on schedule and provide opportunities for important course instructor feedback during the online education process. This strategy may allow students to receive both individual and group feedback early in the term.

Developing a Plan. Providing a plan for group formation is imperative for team success and cannot be underestimated. Helping students choose team members intelligently will aid in the formation of group member roles, allow members of the group to fill needed areas of expertise, and provide a solid foundation for shared esteem among group members.

In a collaborative group effort, certain individuals may be chosen as project manager for the purpose of setting task deadlines or resolving conflicts of opinion. Group members must also be convinced that the work can be completed in the allotted time.

Once set, group members should hold each other responsible for meeting deadlines with weekly meetings and encouragement. In every group effort there will be differences of opinions. Group members must be reminded that conflicts concerning the assignment can be resolved by listening to all arguments, debating, and coming to an effective decision. Decisions must be based on ideas and not on personalities. In the rare cases where conflicts could be at an impasse, group members can put the issue to a vote.

Team Member Qualities. Having said all of the above regarding the effects faculty can have on the success of group activities, it must be noted that successful teams will have certain member qualities. Among those sought-after qualities are an interest in other team members beyond the task at hand, the capacity to clarify and commit to goals, an open and honest evaluation of team performance, an understanding of others' perspectives, a wish to confront conflict positively, a commitment to make decisions inclusively, the valuing of individual differences, and a willingness to freely contribute ideas and encourage that in other team members (Robbins & Finley, 1995). Thus, the qualities of the team members will play an important part in the success of the assignment.

CONCLUSIONS

This paper has provided some personal observations about the nature of cooperative learning as a teaching strategy for online learning. Online collaborative project-based assignments can be a rewarding experience if certain factors are incorporated into the teaching strategy. A skilful facilitator, capable of balancing guidance with flexibility is one crucial factor. Another is a group with the skills, both technical and social, to truly collaborate in the learning process. When those crucial factors as well as other pedagogical issues come together in a learning setting, collaborative online assignments can result in a product exceeding the expectations of the teacher.

It is hoped that a useful model will be developed to enable instructors to use online software management systems like Blackboard. It is also hoped that the pedagogical issues of teaching online discussed throughout this paper will be used by faculty. As higher education institutions seek to make decisions about how to structure online courses for collaborative, cooperative learning, it is hoped that administrators and faculty alike can gain valuable perspectives and insights for the decision process.

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THE IMPACT OF NEW TECHNOLOGY ON MUSIC APPRECIATION COURSEWARE CREATED AND USED FOR A COLLEGE DISTANCE LEARNING COURSE

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INTRODUCTION

In an earlier paper (Sonnenschein 1998), this author described the design of a stand alone, self-paced, computer-mediated, interactive, multimedia music appreciation courseware program that included a novel method for its delivery. Since then there have been many new developments in technology. The current paper discusses new developments in course delivery and in the application of the new developments in technology to the creation of learning modules.

THE CURRENT COURSEWARE

The Anatomy of Music (Sonnenschein 2002) was created as multimedia courseware and was used for an asynchronous distance learning system. The reasoning that led to its creation was based on a number of assumptions and observations. The hypothesis was that, typically, students who enroll in a music appreciation course have had little or no formal music education. This means that it is unrealistic to expect these students to be able to read music. Nevertheless, most music appreciation texts do include a hefty amount of musical notation. These notations are supposed to help "demonstrate" particular musical events under discussion in the text and thus explicate them to the reader.

A Dilemma. A dilemma faced by music educators and by authors of music appreciation texts is that masterworks of music do not come with generally observable markers. Uninformed listeners have no way of locating the musical event discussed in a text while listening to the music itself.

Consider the following: a music appreciation text describes an event in a particular concerto as being "a varied version of the codetta of the tutti exposition." Any unknown word can be looked up in the glossary or in a music dictionary. But how is the learner to locate that event while listening to the concerto? Furthermore, how is the learner to compare the varied version with the original of which it is a varied representation?

A skilled classroom instructor can demonstrate the musical event by using a keyboard. While this and other methods are used frequently, their long-term effectiveness is open to debate. What percentage of students actually benefits sufficiently from these methods so they can locate these events again when listening later on their own to a performance of that concerto?

A Solution to a Dilemma. Based on these and other considerations, as well as on constructivist precepts, the program was developed to provide students with an interactive tool that would let them develop their listening skills by practice and experimentation.

Listening skills had to be defined and adjusted to make them appropriate for non-music majors. Guided by this constraint, the designing phase of the program centered on locating achievable and meaningful listening, i.e., learning objectives.

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Musical Forms. Composers who were active from the Baroque through the late Romantic periods (17th—early 20th century) adhered to compositional "blueprints" that changed little during those periods. Musicians refer to these blueprints as musical forms. Musical forms represent the syntax of music. They are abstract prototypes of classes of compositions. Classes of compositions include all compositions that have the same syntax pattern. Most students, if instructed effectively, can discern these patterns aurally. Mental and auditory comprehension of these patterns facilitates cognition of many important details of countless different masterworks of Classical music.

Design of the Courseware. The courseware's design makes use of synchronized audio and visual cues. The interactive property of the courseware allows for unlimited repeats and comparisons of any specific component of a composition. These capabilities make it possible for the learner to "retard" the ephemeral quality of music. This, in turn, allows for a detailed study of various components and for relating these to any relevant written explanation.

The courseware includes three CDs containing all the music required for the program and can be accessed by way of the CD-ROM drive. The program itself also includes historical background information related to the music on the CDs. Testing modules are part of the program and designed to monitor student's progress in the development of listening skills. A comprehensive final examination is also included in the program.

Design for Distance Education. *The Anatomy of Music* has now been used for some time as a major component of an on-line Introduction to Music course at the College of Arts and Sciences of Northeastern University. It is entitled "Music: A Listening Experience" (http://blackboard.neu.edu/?bbatt=y?bbatt=y). A mandatory orientation meeting is convened at the beginning of each term the course is offered. During these meetings, students receive an overview of the course's content and also a detailed introduction to distance learning procedures in general and how these apply to this course. By way of a computer generated audiovisual demonstration, students are instructed on how best to benefit from this instructional method. This demonstration walks students through the necessary processes and operations that are necessary for this on-line course. Students can also meet with the instructor during pre-scheduled office hours throughout the term and obviously via email.

A New Use for the Course

During the summer term of 2002, this course was offered for the first time as a distance-learning course by Northeastern University's University College. This college caters to part-time students and continuing education students. Students of this college who partake in a distance-learning course are all off campus. Consequently, there was no orientation meeting and all descriptions and explanations were done without physical contact between students and instructor.

The physical setup for the course involves two separate servers. One of these is Blackboard and the other is operated by the publisher of the program. Blackboard serves. as the portal to the course. Students who have registered for the course at the university must also register for this class on Blackboard. Once on Blackboard, students have access to the syllabus and other permanent and temporary postings that apply to the course. Also, they receive e-mails the instructor sends to the class. The Course Calendar contains all the schedules for upcoming quizzes, deadlines and other pertinent information. Students can monitor their performance in the class by checking their current grades. All quizzes are posted on Blackboard for a specified period and once removed, the correct answers replace the question.

The publisher of the software, Tinoteca, Inc. (http://www.tinoteca.com) provides both the academic and general versions of the program. The academic version contains a testing module. Students must obtain the program directly from the publisher. They receive the CDs and access to the publisher's server. The software program and the guidebook are downloaded from the server. This arrangement was established to reduce the costs to the students.

Running The Program. Once the students have downloaded the program from the server to their computer, they can open and run it. At first, they are prompted to enter user name and password. If verified by the server, students can begin working with the program. The program contains learning tools and exercises. When students feel that they are ready, they can access the testing module.

Self-Tests. Each chapter has a self-test. Chapter self-tests have to be taken on-line and in sequence. Successful completion of a chapter self-test is determined by accumulating a pre-determined score of points. Test scores are accumulated on the publisher's server. Once the required score has been reached, an instantaneous automatic e-mail confirmation is sent to the student. Currently, the instructor has to enter these scores manually into blackboard's online grade book.

Self-tests are designed to test students on basic aspects of listening skills. These include tracing and parsing of a musical composition with an understanding of its syntactical design.

Quizzes. Quizzes are not part of the software program but are introduced by the instructor. They are intended to provide the instructor with flexibility to adjust the course in many ways. The main function of the quizzes is to broaden the student's perspectives. Currently, the instructor concentrates on "music cognition by auditory perception." Consequently, the quizzes are designed to develop additional levels of listening skills. For example, in addition to requiring students to be able to trace a composition in accordance with its particular syntax, students should be able to compare and differentiate between various segments of the composition. If desired, the instructor can post additional reading and/or listening assignments.

Requirements. There are no pre-requisites for this course and students do not need music reading skills. They do need, however, good computer skills and a computer in good working condition with a connection to the Internet.

UNDERLYING EDUCATIONAL THEORIES

Every instructional endeavor is inevitably related to some educational theories. The program presented in this paper is no exception. The tenets upon which this program is founded are somewhat eclectic. They do not belong to any single school of thought. This is not uncommon in non-dogmatic approaches to education.

The following discussion is based on the assumption that the student population, for whom this program and other music appreciation courses were developed, possesses only a limited knowledge base, if any at all, that includes a capability of reading and comprehending musical notation. This means that for this program, other didactic methods had to be explored.

Listening. The approach suggested here is that students should learn about music by listening. Students should develop an expandable auditory knowledge base. The objective is not the memorization of any number of musical compositions; on the contrary, this writer agrees strongly with Bruner (1963) that an understanding of general principles is of greater value than is the accumulation and memorization of many examples in which such a principle is observable. In other words, the development of an auditory knowledge base should be achieved by deduction rather than induction.

A Shared Knowledge Base. The discipline of music encompasses both verbal and non-verbal knowledge. It is critical that the instructor and the students have some kind of shared knowledge base in order to communicate effectively. The attainment of verbal knowledge in music, so called book knowledge, is accessible to most students because the means, by which this knowledge is communicated, written language or musical notation, uses skills the instructor and students already share. These skills include the use of language, which is already part of any student's knowledge base.

As to musical notation, which is also a kind of language, this skill too can be attained through the use of a general language. The only requirement is a willingness to allocate a considerable investment of time. Clearly, it is the non-verbal component of musical knowledge that is so difficult to communicate to others who lack that knowledge base. And if the non-verbal is also to include emotional content, communication is all but impossible. The basic question is how to construct a non-verbal knowledge base that instructor and students can share so this base can be continuously expanded.

Music Content. The fact that the content of this program is limited to Western "Classical" music exclusively is due in part to the agreement with what educational philosophy calls academic theories. This school of thought stresses the importance of essentialism, classical works, liberal arts, Western culture, and basic general education among others.

Another and equally important reason, however, is based on the fact that composers who lived and worked in that part of the world and during that time period composed music for listeners who were music amateurs. A good example of this concern that composers had for including the non-professional public into the realm of their intended audience is represented by a series of compositions by C.P.E. Bach, one of the sons of J. S. Bach (Sadie, 1980). He composed and published a collection of sonatas, fantasies, and rondos for keyboard that included in the title of the collection that they were specifically intended for connoisseurs and amateurs.

Composers in general took great pains to make sure that what they wrote was accessible to average listeners and, of course, that their compositions were enjoyable. They all followed the unwritten universal rules of composition with extraordinary self-discipline and ventured into new territories only sparingly.

The homophonic style of the selected culture and period presented a simplification in texture from earlier periods and thus created an art form that was significantly easier on the listener. Not only was there a clearer distinction in the music between main subjects and ancillary materials, but also schemas such as cadences, harmonic progressions, modulations, orchestration, and similar devices were regularly employed by all composers, and could be more or less recognized by listeners and therefore made for a higher degree of predictability.

The writer of this program disagrees with Karl Marx's contention, which seems to suggest that progress is synonymous with improvement (Russell, 1972). The arts in general cannot be compared to the sciences, where new discoveries can and do lead to the obsolescence of older "truths." This is definitely not the case in the arts where new creations are added only cautiously and sparingly to the ever-expanding repository of cherished artistic treasures. In addition, in agreement with this writer's leanings toward an academic learning theory it is believed that the musical subject of this program belongs among the great achievements of humankind.

Because composers of "Classical" Western music followed the unwritten rules of composition that included concepts of design formats or a musical syntax, this music lends itself superbly to serving as a tool for developing listening skills in the learner.

Musical Forms and Scaffolding. The term that music professionals use for what was called design formats above is musical forms, as noted earlier. Musical forms can be seen as abstract prototypes of classes of composition. Though two compositions in the same form share a basic "Gestalt," they are, of course different in a myriad of details. Compositional forms are characterized by their isomorphism, as defined by Hofstadter (1979).

Musical forms, because of their isomorphism, contain many predictable occurrences. Most learners with some practice can recognize these occurrences. The importance of recognizing these occurrences is that they serve as landmarks for orientation.

In order to listen to a composition with a degree of understanding, a listener has to be aware of specific landmarks and their locations along the route of the composition. These orientation landmarks are of great importance when creating mental scaffoldings for constructing an expandable knowledge base. A simple example:

> *A learner has attained some skill in discerning by listening to two different occurrences, A and B. These occurrences are now part of a shared knowledge base between instructor and learner. The instructor can now expand the learner's knowledge base by adding more information about the occurrences. There may be*

difference in orchestration, keys or modes between A and B, which the instructor can now explicate.

The interactive design of the program permits the learner to practice and experiment. This agrees with one of the major tenets of constructivism. As was pointed out at the beginning of this section, the educational theories buttressing this program come from several educational philosophies and thus should be considered to be eclectic to some extent.

CURRENT AND FUTURE DEVELOPMENTS

CD-ROMs. Development of technology is an ongoing and rapidly changing process. The impossibilities of yesterday are becoming the norms of today. When CD-ROM technology was first introduced, it was seen as the ultimate answer to storage and use of large data files.

Electronically speaking, recorded music requires an inordinate amount of data storage space. A typical CD can store about 560 MB of data. In musical terms, this is equal to approximately 70 minutes of recorded music. This made the CD-ROM technology ideally suited for the development of musical programs.

There is also, however, a distinct drawback attached to the use of CDs and CD-ROM technology. Courseware packages designed with CDs are by necessity static in nature. The music has to be pre-selected and once the CDs are burned, they cannot be altered. The attendant applications are usually linked to the specific CDs.

Whereas such pre-packaged formats make the courseware decidedly user-friendly for the students, its static quality limits the usefulness of such courseware for other instructors. Using such a courseware presupposes agreement with the educational philosophy, methodology, and musical selections that are inseparable from such a program. Any changes would require a production of new CDs and the creation of a new application program.

MP3 Technology and its Implications. The advent of MP3 compression technology created a paradigm shift in the thinking of authors and developers of distance learning courseware. MP3 made it possible to compress large amounts of music data into a relatively small file. These smaller music files made it realistic to place them on a server for users to download onto their computers.

The above has important implications. A courseware designer can now create any number of music files containing separate music examples and rather than burn them on a CD, store them on a server bundled together with the attendant computer application. Each of these bundles represents a content module. These content modules make it possible for any instructor to select only such modules as s/he requires. The server serves as a repository for modules that can be continuously expanded with additional modules. Instructors can even request the creation of a particular module. For example, an instructor can ask for a module on "Berlioz's Symphonie fanstastique," and, if interested, provide the designer with any desired text files to accompany that module.

Current Trends. The latest trend in the development of course related software is moving increasingly toward modular design. As David Brown (2002), who calls modules "chunks," stated, "I want the freedom to choose the best for each course segment." (p. 22). He believes that "We're entering the Era of Chunks" (p. 22).

This writer is currently preparing a module on the solo concerto in the Baroque. The first step involved researching the current status of scholarly literature. A selection of primary sources, i.e., the music, was made and then subjected to a formal analysis. Based on this selection, recorded examples were transferred from CD to MP3 files. A tool was prepared that the developer used to create the MP3 files and the interactive graphic representations (form-charts) based on the analyses. The developer used this tool in real-time while listening to the music and following the musical score.

A player-tool was also prepared to play the completed interactive graphic representation. Form-charts, player, music file, and text file were bundled and placed on the server. This enabled users to download the bundle and study the downloaded music file using the interactive form-chart. The text file contained synopses of historical and biographical background information related to the music. When completed, a selected bibliography will also be included.

The modular approach to the creation of course software is obviously not restricted to any one discipline. There are already many sites available for downloadable modules. For example, Brown lists two such sites. They are (www.merlot.org) and (http://iccel.wfu.edu/gallery) and both are worth exploring.

SUMMARY AND CONCLUSIONS

This paper described an online music appreciation program and its pedagogical foundations. Technological limitations at the time of the original creation of the program limited the program to the use of CD-ROM technology. Because of the continuous developments in technology, developers of courseware are rethinking their options.

This paper also described the impact that MP3 technology has had on the development of music appreciation programs. The main implication is that CD-ROM technology now becomes replaceable by MP3 compression technology. This permits moving from static courseware programs to more dynamic modular courseware constructions. This is in accord with current trends that promote the creation of downloadable learning modules.

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IMPROVING STRATEGIC KNOWLEDGE IN PHYSICS

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INTRODUCTION

In Romania and elsewhere, the assessing commissions and most physics teachers observe a great discrepancy between the relative ability of students to solve standard physics problems and their ability to apply the same computational skills to novel situations. They also observe a gap between students' ability to define and describe basics scientific concepts and processes in classroom and the use of these understandings to explain the real world's phenomena. Any evaluation of the teaching system reveals at least two conclusions—instruction is still a transmission process and achievement methods are based on behaviorist theory.

Current instruction in the behavioral sense refers to the transmission of knowledge from the teacher to students as passive listeners (Mestre, 1994); learning happens when this knowledge is transmitted to and acquired by learners. Cognitive and constructivist approaches offer new and more effective perspectives in learning. Cognitive science has undertaken the study of the mental processes used to acquire, store, transform and use knowledge, providing a deeper understanding of learning and problem solving.

Constructivism has significant implications in educational science. From a constructivist viewpoint, learning is an active process of constructing, rather than acquiring, knowledge. The goal of instruction is to support that construction rather than trying to transmit knowledge. Learning is an individual experience of constructing meanings, schemas, or new mechanisms of learning from direct exploration of the environment. This process is influenced by the individuals' prior knowledge structures, emotions or abilities; the knowledge that we already posses affects our ability to learn new knowledge. The major role of the teacher is creating an adequate learning environment, organizing study and giving feed back.

The tests currently used in school evaluate only the final manifestation of competence. This is, of course, in line with behavioral theory, as opposed to individual understanding of knowledge or the subject's ability to use the knowledge learned in novel contexts (Hestenes et al., 1992).

The recommendations in the project described in this paper are addressed to the problems encountered in physics teaching as identified above. The project was created to support teacher training and provides a theoretical basis for interventions, teaching methods and strategies based on experimental research.

THEORETICAL FOUNDATIONS

The ACT Model

The main theoretical assumptions of the teaching model comes in principal from the ACT model (Anderson, 1985) of cognitive architecture, based on the results of cognitive studies of expert/novice differences in problem solving. It speaks from a constructivist perspective about teaching and learning. The ACT model offers remedies for the often noticed discrepancy between the level of conceptual and procedural knowledge of students and their ability to use this knowledge for problem solving.

The ACT model attempts to give a general explanation for skill learning and problem solving in all domains and describes the functional relationships between long-term memory and working memory (Anderson, 1985). In this model there are two distinct structures: the declarative memory—organized in semantic networks; and the procedural memory—organized in terms of production rules. The working memory is said to be "the more intensely activated part of the long-term memory" (Miclea, 1999, p. 319). The specific knowledge from long-term memory can be accesed in working memory by means of production rules. These production rules (if-then rules or condition-action pairs) enable knowledge transfer from long-term memory to working memory.

Figure 1
The ACT model of the cognitive architecture (Miclea, 1999)

DECLARATIVE MEMORY PROCEDURAL MEMORY

Reactualization Storage Mapping Execution

WORKING MEMORY

Encoding Performance

Practically, a problem that an individual wants to solve will be represented at the level of working memory. Given the rules of production, the data of the problem (which were present at some point in the working memory), will activate specific knowledge and procedures from long-term memory. The new knowledge thus produced by working memory will produce, in its turn, knowledge or corresponding rules in long-term memory. If knowdledge is used repeteatedly in solving problems, the cognitive architecture builds new, domain-specific production rules.

Procedualization and Composition. Anderson (1985), the creator of the ACT model, believes one can speak about actual learning only when the individual can generate new rules of production starting from the declarative knowledge s/he has already acquired. The generation of the rules of production usually comes as a result of one of the following two processes: procedualization and composition.

Procedualization means building the facts into production rules directly. This eliminates the need to search declarative memory for a specific fact and allows the individuals to use the fact directly whenever the condition associated with it becomes active in working memory. Composition combines rules repeatedly used in sequence into a single rule that gives the same overall result, with the consequence that the final result can be reached more quickly.

Inert and Active Knowledge. Cognitive scientists identified from the ACT model a specific distinction between "inert knowledge"— knowledge which although present in the long-term memory, is not activated appropriately by the contexts of the problems or by the requirements of the short-term memory; and "active knowledge"—which is useful for problem solving and available whenever necessary. An essential difference between inert and active knowledge lies in their nature. Most inert knowledge is stored in memory as verbal propositions or memorized facts, whereas active knowledge is represented in cognitive terms as rules of production or as condition-action pairs. The condition is the element which specifies "when" the action can be applied).

Clustering and Functional Relationships

The Physics Education Research Group from the University of Massachusetts (Dufresne et al., 1995) described the principal differences among experts and novices concerning knowledge structure. They outlined two kinds of differences. These related to conceptual knowledge clustering and functional relations between conceptual, procedural and problem-state knowledge. See Figures 2 and 3 below.

Figure 2
A Representation of an Expert's Structure of Knowledge (Dufresne et al., 1995)

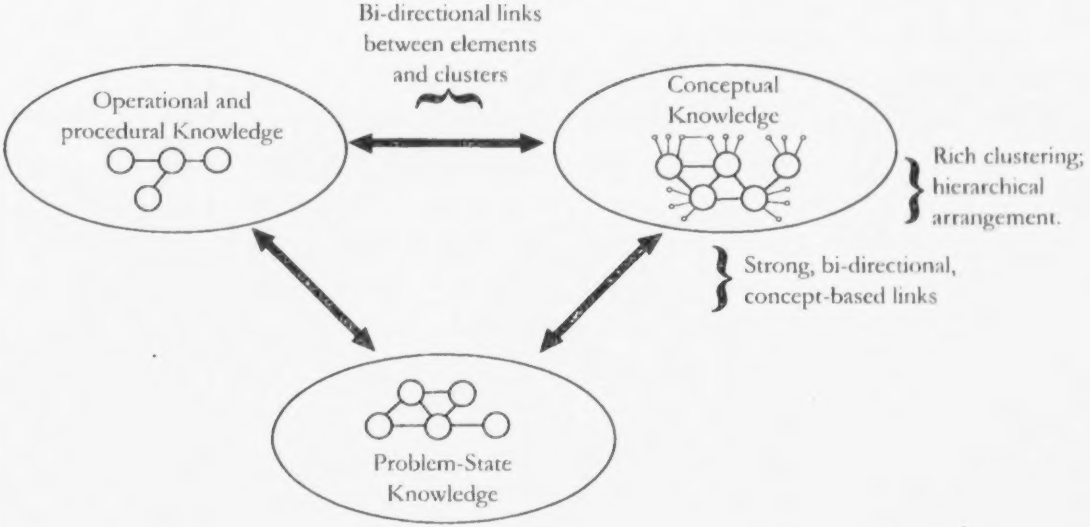
Bi-directional links between elements and clusters
Operational and procedural Knowledge
Conceptual Knowledge
Rich clustering; hierarchical arrangement.
Strong, bi-directional, concept-based links
Problem-State Knowledge

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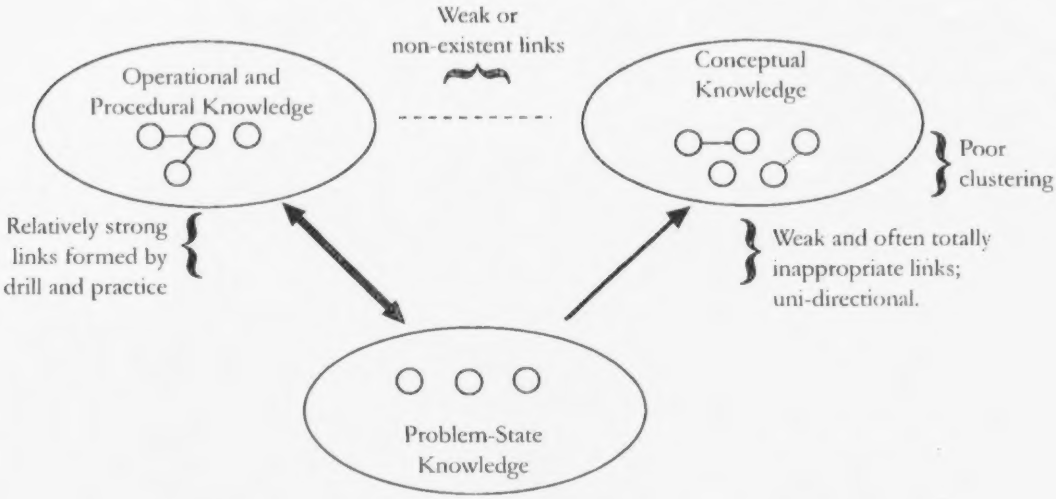
Figure 3
A Representation of the Novice's Structure of Knowledge (Dufresne et al., 1995)


Weak or
non-existent links
Operational and
Procedural Knowledge
Conceptual
Knowledge
Poor
clustering
Relatively strong
links formed by
drill and practice
Weak and often totally
inappropriate links;
uni-directional.
Problem-State
Knowledge

Experts have a rich clustering of concepts, each concept being related to many others, in a hierarchical structure, around an umbrella-concept. The relations between them are clearly understood. Experts have many operations, equations and procedures, a large store of problem-state knowledge and specific procedural rules. The links between each pairs of knowledge categories are very strong.

When the subject is facing to a problem, the conceptual knowledge is used to decide the applicability and the appropriate use of procedural knowledge and this procedural knowledge can be quickly accessed according to task demands. Umbrella concepts can group elements between the three categories, forming a new sort of

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knowledge: strategic knowledge. Its implies "a strong bond between a conceptual cluster, the recognition of the circumstances making the concept applicable, and the procedures needed to apply them" (Dufresne, et al., 1995 p. 3).

By contrast, novices show a disconnected and amorphous knowledge structure. They do not use umbrella concepts and frequently have inappropriate links between concepts which lead to misconceptions (Dufresne, et al., 1995). The problem-state knowledge category consists in a small number of problem situations, poorly related and clustered according to surface features. Novices have a large store of operational and procedural knowledge but they do not use these efficiently in problem solving. Links between concepts and procedures in problem situations are week, so, novices cannot analyze the problem and select or activate the appropriate operation to solve it.

The model presented in fig. 3 can explain the situation observed in many classrooms in which students cannot solve novel problems, despite the fact that they can reproduce many procedural strategies. Strategic knowledge construction seems to be a critical feature that differentiates the experts problem solvers from novices.

PROJECT DEVELOPMENT

Purpose

The main purpose of the project was to improve physics teaching in order to help students achieve strategic knowledge.

Methods

Concept Mapping. Concept mapping can accomplish two objectives: 1) provide a deep conceptual understanding—facilitating strategic knowledge construction; and 2) reveal possible misconceptions. This method can be used to represent how concepts within a domain are interrelated. Developed by J. D. Novack (1983), it is based on a constructivist assumption that new knowledge is constructed or gains meanings depending on prior knowledge.

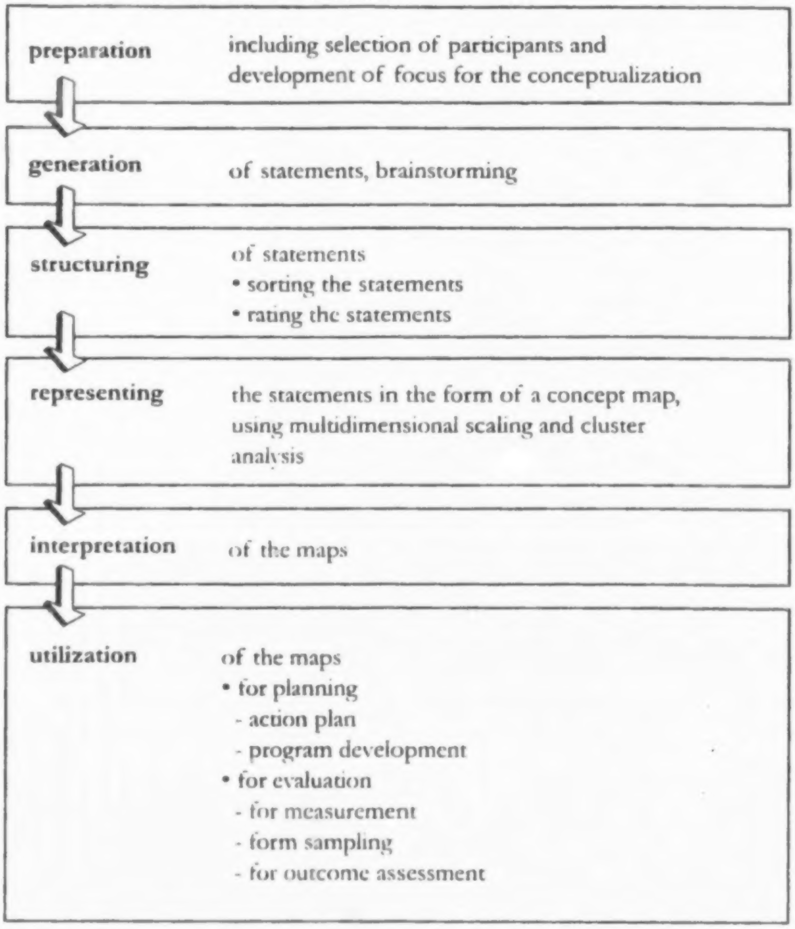
More concretely, a concept map is a technique for visually representing a structure of information and is a hierarchically arranged structure of nodes containing a concept, item or question and labeled links. The relationships between nodes/concepts are indicated by linking words and an arrow symbol to describe the direction of the relationship (Novak, 1991).

The practical development of conceptual maps implies the following activities (Fraser et al., 2000):

1. Identify the key concepts
2. Rank the concepts by placing the broadest and most inclusive at the top of the map
3. Work down the paper and add more specific concepts
4. Connect the concepts by lines—label the lines with linking words that define the relationship between the two concepts so that it reads as a true statement or proposition
5. Look for crosslinks between concepts in different sections of the map, and label these
6. Specific examples of concepts can be attached to the concept labels
7. The same set of concepts may be represented by many different map forms

The method consists of six stages identified in Figure 4.

Figure 4
Developing a Concept Map (Fraser, et al., 2000)


preparation
including selection of participants and development of focus for the conceptualization
generation
of statements, brainstorming
structuring
of statements
• sorting the statements
• rating the statements
representing
the statements in the form of a concept map, using multidimensional scaling and cluster analysis
interpretation
of the maps
utilization
of the maps
• for planning
- action plan
- program development
• for evaluation
- for measurement
- form sampling
- for outcome assessment

Concept maps foster better clustering of conceptual knowledge and better linking with the procedural and problem-situated knowledge. The major goal of these maps is to facilitate the construction of strategic knowledge.

A concept map can also reveal and correct subjects' misconceptions. Conceptual change is a complex process. Posner et al. (1982) argued that four conditions need to be presented in order for students to undergo a conceptual change:

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> *Students must become dissatisfied with their existing conception; if students believe that their (erroneous) conception accurately describes scientific phenomena, they will not see a compelling need to change it*
>
> *Students must view the scientific concept; without some initial minimal understanding students cannot begin to appreciate its meaning*
>
> *Students must view the scientific concept as plausible; if the scientific concept is incompatible with other concepts residing in the students' memory it is not likely that serious consideration will be given to it*
>
> *Students must view the scientific concept as useful for interpreting or predicting various phenomena*

Anchored instruction. This tehnology-based method was developed by John Bransford and the Cognition & Technology Group at Vanderbilt (Bransford, 1990). It reflects a constructivist point of view—knowledge is actively aquired (constructed) from exploring the environement.

Anchored learning aims to create shared problem-solving contexts ("anchors" for learning) that allow students to solve problems. The method was developed based on the distinction between the two categories of knowledge—inert and active (from the ACT model).

Anchored instruction places learning within a meaningful problem-solving context used as a learning device. Anchoring refers to the bonding of the knowledge content within a realistic and authentic context.

The shared contexts—generated with multiple modern technologies—are designated to generate interest and help students to acquire metacognitive skills, since students must explain and justify to others their problem-solving strategies. One important goal of this method is making the learner not only solve problems, but think about the thought processes involved.

Principles of anchored instruction are as follows (Bransford et al., 1990):

- Learning and teaching activities should be designed around an "anchor" which is based on a contextualized case study or problem situation
- Curriculum materials should allow exploration by the learner (e.g., interactive sites)
- Learners should take ownership
- complex content is involved, solved through interconnectedness of sub-problems and multiple scenarios
- Problems are presented in a narrative format; a story with embedded data
- Learning context is generative (students identify with problem and become actively involved in generating solution)

Evaluation

The efficacy of the suggestions in this project can be evaluated through administration of a test to students containing conceptual questions, standard problems and completely new problems. An efficient intervention can be concluded only if it is possible to observe a significant improvement in students' performance in solving new problems—performance which can be attributed to the intervention..

CONCLUSIONS

An analysis of experimental studies and cognitive models suggests traditional instruction in higher education can be facilitated by applying the constructivist learning model and using problem-oriented approaches (Bransford et al., 1989). The advantage of problem-oriented teaching (i.e. introducing new knowledge while a problem is being solved) is that it makes it possible for new rules of production to be generated, the stress being put this time on the conditions of applicability of the learned procedures. Bransford et al. (1989) have shown experimentally that students who learned a scientific text in a problem-oriented manner could associate applicability conditions with the facts they had learned, and that this method helped them recall and use the facts for solving new related problems.

This new conceptualization of learning is necessary in order to solve a deficiency systematically observed in educational systems—students' inability to apply learned knowledge in new situations.

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TEACHING MARKET FAILURE THROUGH INTERACTIVE INSTRUCTION

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INTRODUCTION

Early in their coursework, students in college economics courses are introduced to the virtues and shortcomings of the self-interested behavior of individuals. Mainstream economic theory teaches that if a market adheres to a few simplifying assumptions, the self-interested behavior of consumers and producers will drive the invisible hand of the marketplace to create great wealth for its participants. If one of these assumptions is violated, market failure will occur resulting in a sub-optimal outcome for the economy. This paper conveys a teaching strategy that uses the theoretical structure of the Prisoner's Dilemma (1997) and interactive instruction to teach undergraduates about the causes of and solutions to market failure.

The application of theory to policy is a common exercise for a professional economist, and Carlson and Schodt (1995) have used the case study method to teach students to "think like economists". They discovered that a focus on problem solving helped students to develop analytical skills, frame questions and use theory to explore policy outcomes. In addition, students reported that the problem solving approach not only contributed to their understanding of economic theory and their ability to apply it to policy, but they found such classes more interesting than straight lecture presentations.

Velenchik (1995) also reported success in combining theory and real world economic problems to teach policy analysis in an international economics course for undergraduates. She found that using cases after the presentation of the relevant economic theory was effective in "inducing students to apply theory, use evidence, and recognize the legitimate range of application of economic analysis" (p. 34).

TEACHING METHOD

Game theory studies the strategic interactions of agents (individuals, firms, countries, etc.) in situations in which each agent has an effect on the outcome but cannot completely control it. The Prisoner's Dilemma (1997) provides a striking result that if each agent acts in his/her own self-interest, each will be worse off than if they had cooperated with each other.

There are many variations on the story behind the common resource application of the Prisoner's Dilemma (1997); however, the basic incentive structure is the same. This story is taken from the version of the game from the National Endowment for the Humanities (1997) seminar at Saddleback College. This student centered, problem-solving activity begins by seating students in a circle and presenting them with the following problem:

> You are a fisherman who makes his living by fishing open waters that are not privately owned. Each time you go out in your boat, you may take as many fish as you are able to. You must decide to either fish by conventional methods or to use high tech trawling. If you fish by conventional methods, you will bring in a modest harvest but the fish population will be sustained. If

> you trawl, you can bring in the largest harvest possible this season, but eventually, there will not be enough fish to adequately reproduce, and the fish population will be destroyed. Every fisherman faces the same choice.

The outcomes of the individual's decision, as well as those of the other fishermen can be represented in the following normal form game.

Figure 1
Common Resource Problem

		Fisherman A	
		Trawl	Small Harvest
All other Fishermen	Trawl	Big Temporary $, Big Temporary $	Very Big Temporary $, Small Temporary $
	Small Harvest	Small Temporary $, Very Big Temporary $	Sustainable $, Sustainable $

No matter which option the other fishermen take, the individual has an incentive to trawl. This leads to the depletion of the common resource. If one fisherman trawls, all others have an incentive to trawl as well (receiving big temporary $$ as opposed to small temporary $).

It is striking that self-interest does not provide these participants with the best possible outcome, resulting in market failure. If each fisherman acts in his/her own self-interest, the outcome will be worse for each than if they had felt some responsibility for the welfare of society. In this application, if each fisherman acts unilaterally in his own self-interest, each will trawl, and the natural resource will be depleted. However, if each individual makes his choice with the well-being of the community in mind, each will choose conventional fishing methods (or come to a binding agreement not to trawl) in order to maintain the common resource. Even if the community acts without a sense of social responsibility, public policy can enact regulations regarding fishing methods and the use of public waters to correct the market failure.

In this activity the student is required to actively make decisions as a fishing village by having each student commit to a unilateral decision before revealing it to others in the class. It is possible to do so through a more elaborate game in which each student must take a certain quantity of an item (symbolizing a fish) out of a hat, representing his/her catch for the season. As with fishermen coming back into port with their catch, students see how many fish the other students took.

Students participate in two or three rounds of the game without being permitted to speak to one another. In almost every case, the common resource is depleted as a few individuals over-fishing continue their behavior, and others begin to over-fish as they begin to realize that the stock will eventually be depleted anyway.

Students play the game over, but this time, they are permitted to talk to each other before each round. This method makes the need for a binding agreement clear as students begin to impose rules on the individuals taking too many fish. Thus, students identify the enforceable regulation as one possible public policy solution.

After presenting the Prisoner's Dilemma (1997) and the common resource application, students are given a real world application of the above theory and a set of questions to work on outside of class. For example, Maine lobster fishing is a relevant application for schools in the Northeastern United States, but the actual case used can be altered given the geographic location of the school.

Materials consist of reports mainly from regulatory organizations, such as the National Oceanic and Atmospheric Administration (2001). In the case of lobster fishing in Maine, the case materials cover topics such as the history of lobster fishing and population numbers, weight and length requirements, maps of managed areas, legal definitions of over-fishing, and legislation on the conservation and management of fisheries (including the Magnuson-Stevens Fishery Conservation and Management Act and the Sustainable Fisheries Act).

Students are expected to prepare questions, which are used as a tool to bridge the theoretic framework with the facts of the actual application. Some examples of questions include the following.

- In the absence of any regulations limiting lobster fishing, if each lobster fisherman acted purely in his/her own self-interest, what would be the outcome?
- What would be the outcome if each lobster fisherman acted with the best interests of all fishermen in mind?
- What is the source of the market failure?
- How can the market failure be corrected?
- What legislation is in place to deter the over-fishing of lobster and what restrictions do they place on lobster fishermen?
- How well are these laws enforced?
- Has regulation effectively prevented the over-fishing of lobster in the Northeast?

RESULTS

The above example was originally designed to introduce the concept of market failure in an "Introduction to Microeconomics" classroom. After spending the majority of the semester studying how self-interest drives the invisible hand of the free market economy to produce an efficient outcome, students are interested to investigate a clear example of where this breaks down. With few exceptions, students are drawn in by the use of a real life policy question, and the foundation of the Prisoner's Dilemma (1997) enables them to come to a better understanding of the underlying causes of market failure.

Use of this problem-solving method has resulted in an improvement in the depth of student understanding compared to teaching the above material in a lecture format. For example, students were able to produce examples of commons problems at our school from behavior in the dining hall to the dorm bathroom as well as those in society as a whole. On a cumulative final exam, students are able to explain the causes of market failure, provide possible policy recommendations, and evaluate the pros and cons of different policy options. The emphasis on problem-solving and real world issues gives the class a more policy-oriented approach, something that students value in a course curriculum dominated by theory.

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